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NUCLEAR SCIENCE ABSTRACTS

February 28, 1958

Volume 12 Number 4
Abstracts 2608 - 3472

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NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 4 February 28, 1958

GENERAL

2608 AERE-C/M-223
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FISSION PRODUCT RUTHENIUM: NOTES ON ITS CHEMISTRY IN CERTAIN AQUEOUS SOLUTIONS AND ON THE PREPARATION OF LABELLED AND CARRIER-FREE SOLUTIONS FOR EXPERIMENTAL WORK. PART I. RUTHENIUM CHEMISTRY IN CERTAIN AQUEOUS MEDIA. J. M. Fletcher. PART II. PREPARATIONS OF LABELLED RUTHENIUM COMPOUNDS. F. S. Martin and J. M. Fletcher. PART III. PREPARATIONS OF CARRIER-FREE RUTHENIUM SOLUTION. R. S. Bruce and T. E. F. Carr. Sept. 1954. 11p. (EBR-17K).

Information is presented to assist those engaged in the disposal and in the biological fate of fission product ruthenium. (auth)

2609
RADIATION INSTALLATION REGISTRATION LAW. AN ACT OF THE GENERAL ASSEMBLY OF ILLINOIS. C. W. Klassen (Dept. of Public Health, Springfield, Ill.). Non-Destructive Testing 15, 352-4(1957) Nov.-Dec.

The complete text of a new law in Illinois to require the registration of radiation installations is presented. Radiation installation is defined as any location or facility where radiation machines are used or where radioactive material is produced, transported, stored, disposed, or used for any purpose. The Act includes no measures for controlling or restricting the use of radiation machines or radioactive materials. (L.T.W.)

Atomic Bombs and Warfare

2610
WEATHER DETERMINES BLAST PREDICTION FOR ATOM TESTS. Jack W. Reed (Sandia Corp., Albuquerque, N. Mex.). Weatherwise 9, 202-3(1956) Dec.

Atomic Power

2611
ATOM POWER AND THE GERMAN ECONOMY. Siegfried Balke. Atomics 8, 420-1(1957) Nov.

The increase in energy consumption in Germany is estimated for 1965 and the contribution of atomic energy is discussed. Problems, such as the cutoff of imported fuels due to political crises, are presented. (M.H.R.)

2612
NUCLEAR PROGRESS IN GERMANY. F. R. Paulsen. Atomics 8, 422-6(1957) Nov.

An organization chart of the German Atomic Energy Commission is given. Pictures of the Frankfurt and Garching reactors are given. A map of the distribution of the various nuclear energy activities in Western Germany is included. The activities of the Länder are summarized. (M.H.R.)

2613
ATOMIC RESEARCH IN NORTH-RHINE WESTPHALIA. Leo Brandt. Atomics 8, 427-8(1957) Nov.

The history of atomic research in North-Rhine Westphalia is reviewed. Discussions are included on the "Merlin" reactor, work with isotopes and fissile materials, and energy from fusion. (M.H.R.)

2614
NUCLEAR ENERGY IN THE PUBLIC ECONOMY. E. H. Rudolph Wissell (Berlin Power & Light Co.). Atomics 8, 433-7(1957) Nov.

Parallels are drawn between the energy requirements of West Germany and Great Britain. Some British plans for nuclear power are given as models for Germany. Graphs and discussions are included on the following: primary energy requirements, primary energy imports, home production of primary fuels, demand and supply of electricity, electrical power stations and installation costs, and electricity production in nuclear power stations. (M.H.R.)

2615
NUCLEAR SHIP PROPULSION. AN ANALYTICAL APPROACH. S. G. Bauer and M. H. Kendon (Rolls-Royce, Ltd.). Nuclear Eng. 2, 499-503(1957) Dec.

The knowledge that nuclear energy could be applied to the propulsion of merchant ships in the near future has promoted optimistic speculation on possible economics. A more analytical approach, admittedly including assumptions which can be questioned, produces cost figures which show that minimum nuclear freight rates can approach conventional rates but return on capital investment must be smaller. (auth)

2616
NUCLEAR MERCHANT SHIPS. 1. FIRST U. S. SHIP NEARS THE WAYS. 2. ADVANCED SHIP REACTORS. 3. WORLD-WIDE EFFORTS. Nucleonics 15, No. 11, 78-87 (1957) Nov.

The nuclear-powered merchant vessel whose keel is scheduled to be laid in March 1958 is described. This will be the world's third nuclear-propelled surface ship, but the first one with a completely unclassified power plant. Four advanced reactor concepts for merchant ship propulsion—pressurized water, boiling water, organic moderated, and gas-cooled designs—are described. A survey of world-wide efforts by maritime countries in the field of nuclear surface ship propulsion is presented. (L.T.W.)

2617
PROFIT PERSPECTIVES IN ATOMIC ENERGY. PROBLEMS AND OPPORTUNITIES. SPECIAL REPORT NO. 21.

Elizabeth Marting, ed. New York, America Management Association, Inc., 1957. 176p. $4.75.

Industrial applications of atomic energy are reviewed. Markets for atomic power are surveyed. Topics discussed include regulation and control, hazards and their insurance, and technical and manpower requirements for the development of atomic power. (C.H.)

2618

ATOMIC POWER. AN APPRAISAL INCLUDING ATOMIC ENERGY IN ECONOMIC DEVELOPMENT. Eugene R. Black, John Cockcroft, W. Kenneth Davis, Antonio Carillo Flores, Francis Perrin, Edwin Plowden, Lewis L. Strauss, and Corbin Allardice. New York, Pergamon Press, 1957. 151p. $3.50.

The material given was presented at an informal panel discussion during a meeting of the Board of Governers of the World Bank. Basic reliable facts needed by business men, economists, educators, and other laymen are presented. For those unacquainted with atomic matters, a series of notes on the atom, atomic energy, radioisotopes and related subjects are included. Other topics included are atomic power, electric power from fission, research and development, testing and medical therapy reactors, propulsion reactors, the economics of nuclear power, and the panel discussion itself, "Atomic Energy in Economic Development." In the appendices, are statements by the President and Lewis L. Strauss, the AEC terms and conditions governing power reactor development and international transactions in special nuclear materials, etc., notice of Commission services in chemical processing of spent reactor fuels, and a statement on fuel cost provided by the United Kingdom Atomic Energy Authority. A simple glossary of technical terms is also given. (M.H.R.)

2619

NUCLEAR ENERGY IN THE WORLD. PROGRAMS AND DEVELOPMENTS FORESEEN. Th. Reis. Paris, Dunod, 1957. 303p. (In French)

The following subjects are discussed: units of measure, conversion factors, equivalences and yields; the world energy situation in 1952; evolution of the world energy situation—demands in the years 2000 to 2050; world energy reserves; the European energy situation and nuclear energy; and status and programs in France and several African countries. The history, organization, programs, resources, and accomplishments in the nuclear energy field are reviewed by countries. International organizations are also discussed and much data on reactors, raw materials production, fuel processing, and related topics are tabulated. 320 references. (T.R.H.)

BIOLOGY AND MEDICINE

2620

ACCUMULATION OF DIETARY BORON AND STRONTIUM IN YOUNG AND ADULT ALBINO RATS. R. M. Forbes and H. H. Mitchell (Univ. of Chicago, Ill.). Arch. Ind. Health 16, 489-92(1957) Dec.

2621

STUDY ON THE EFFECTS OF CORTISONE AND ACTH ON REVERSED ANAPHYLAXIS IN NORMAL AND IRRADIATED ANIMALS. Douglas E. Johnstone and Joe W. Howland (Univ. of Rochester School of Medicine and Dentistry, N. Y.). J. Allergy 28, 418-22(1957) Sept.

2622

PROCEEDINGS OF THE DECENNIAL REVIEW CONFERENCE ON TISSUE CULTURE, HELD AT WOODSTOCK, VERMONT ON OCTOBER 8-12, 1956. Philip R. White, ed. J. Natl. Cancer Inst. 19, 467-843(1957) Oct.

2623

DURATION OF SPERMATOGENESIS IN THE MOUSE. E. F. Oakberg (Oak Ridge National Lab., Tenn.). Nature 180, 1137-8(1957) Nov. 23.

2624

DUGWAY FOOD IRRADIATOR USES 8 MTR ELEMENTS. Carl J. Christensen, Andrew Jacobsen, Quentin Klinger, and George Abel (Univ. of Utah, Salt Lake City). Nucleonics 15, No. 12, 94-6(1957) Dec.

Eight spent MTR fuel elements are the radiation source in the Dugway high-level γ irradiation facility, designed especially for canned-food processing. The system will accept any can up to the No. 10 size and deliver a specified uniform radiation dose between 25,000 and 10^7 r. Variation in total dose is limited to a few per cent. Provision is made for temperature control in the range 25 to 200°F. (L.T.W.)

2625

COMMON ERRORS IN OBTAINING AND EVALUATING EXPERIMENTAL DATA. Maurice H. Belz (Univ. of Melbourne). Phys. in Med. and Biol. 2, 3-16(1957) July.

The paper reviews the contribution which statistics and statisticians can make to the design of experiments and the analysis of experimental results in biology and medicine. An account is given of the principles of factorial experiments, in which, with maximum economy of experimentation, information may be obtained on the main effects of a number of individual factors as well as their interactions in an experimental system. The planning of experiments from the point of view of the number of observations necessary to obtain the required information is discussed, particular reference being made to the advantages and disadvantages of the sequential method of planning. Common errors and misunderstandings in the study of regression and correlation and the use of significance testing are described and discussed. (auth)

Radiation Effects

2626 AF-SAM-57-83

Texas. Univ., Austin. Radiobiological Lab.

EFFECTS OF RADIATION ON THE HILL REACTION. Donald R. Anderson. Jan. 18, 1957. 33p.

2627 HW-51318(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

BETA RAY DOSE CALCULATIONS. W. C. Roesch. Oct. 8, 1957. 13p. Contract W-31-109-Eng-52. $0.50(OTS).

The dose rate near an infinite-line source was found. The numerical results fit a simple mathematical expression which can be integrated fairly easily in other problems of cylindrical geometry. This expression and its application in determining the beta ray dose to the wall of an intestine or of a blood vessel and to the thyroid of a sheep are described. (M.H.R.)

2628 UCRL-3880

California. Univ., Berkeley. Radiation Lab.

BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1957. July 29, 1957. 33p. Contract W-7405-eng-48. $0.75(OTS).

Data are tabulated on the incidence of and classification of tumors induced in female mice following administration of μc/g body weight of At^{211}. Progress is reported in studies on the radiation chemistry of proteins, formic acid, and acetic acid. The effect of dose rate in the radiolysis of

aquo-organic systems was investigated. Radiobiological studies reported include back-mutation studies of irradiated yeast, studies of hypothalamic-irradiated rats, the effects of x irradiation on egg hatch and egg-laying in wasps, tracer studies on the rate of formation and life span of lymphocytes, and studies on the embryonic nucleoprotein fraction that stimulates growth in tissue cultures. Health chemistry and health physics activities for the period are summarized. (For preceding period see UCRL-3758.) (C.H.)

2629 USNRDL-TR-186

Naval Radiological Defense Lab., San Francisco.
RADIOLOGICAL HAZARD EVALUATION—A CRITICAL REVIEW OF PRESENT CONCEPTS AND A NEW APPROACH THERETO. E. L. Alpen. Oct. 22, 1957. 33p. Project NM-006-015.

Data are reviewed on the biological effects of whole-body radiation on human beings and the rate of recovery following whole-body exposure as a function of amount of injury. Tabulated data are presented on the estimated medical effects of radiation doses from 75 to 650 r expressed as percentages of working force affected for healthy, young adults for times up to three months post exposure; the acute effects of whole-body penetrating ionizing radiation on human beings; the biological effects of radiation on the skin; and the absorber characteristics of fabrics. An attempt is made to establish criteria based on present knowledge of radiobiological response of human beings for the prediction of radiation injuries. Two estimated dose required (EDR) values are proposed. The estimated effective dose to produce sickness in 24 hrs is 200 r and the estimated effective dose to produce death is 400 r. The estimated effective dose is based upon estimated prompt gamma dose, residual gamma dose, and the neutron dose in rep with no correction for rbe. Corrections should be made for any protection factors present. Findings are applied in the evaluation of hazards and mission accomplishment in military radiobiological situations. (C.H.)

2630

THE EFFECT OF X-RAY TOTAL-BODY IRRADIATION ON THE MAST CELL COUNT IN THE SKIN. AN EXPERIMENTAL INVESTIGATION ON GUINEA-PIGS. Tor Pettersson. Acta Pathol. Microbiol. Scand. Suppl. 102, 1-62(1954).

The mast cell count of the connective tissue in the skin of the back of guinea pigs decreased about 50% following exposure to 600 r whole-body doses of x radiation. No further decrease occurred at doses of 1320 r. Since mast cells are sources of heparin, a possible correlation between the number of mast cells and the tendency to hemorrhage consequent to whole-body irradiation is suggested. 103 references. (C.H.)

2631

THE INFLUENCE OF OXYGEN ON THE RADIOSENSITIVITY OF MAMMALIAN TISSUES. E. A. Wright and P. Howard-Flanders (St. Mary's Hospital Medical School and Hammersmith Hospital, London). Acta Radiol. 48, 26-32(1957) July.

The radiosensitivity of growing bone in the tail of week-old mice has been determined when the tissues were made anoxic by compression and when the animals were breathing partial pressures of oxygen ranging from half an atmosphere of air to three atmospheres of oxygen. When irradiation doses in the form of fast electrons, delivered in approximately one second, were used the tail reached minimum sensitivity following compression in four seconds. The changes in radiosensitivity found under these conditions are discussed in relation to the special anatomy and physiology of the sensitive cartilage cells concerned with the growth of the bones. The relation of these results with other work on mammalian tissue and cells is also discussed and some possible practical applications to radiotherapy are considered. (auth)

2632

EARLY EFFECTS OF WHOLE BODY IRRADIATION ON CHOLINESTERASE ACTIVITY IN GUINEA-PIGS' BLOOD, WITH SPECIAL REGARD TO RADIATION SICKNESS. Johan Lundin, Carl-Johan Clemedson, and Arne Nelson (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Radiol. 48, 52-64(1957) July.

Male guinea-pigs suffered a loss of cholinesterase activity in plasma amounting to about 30% during the first two days after whole-body roentgen irradiation with 400 r. No changes in the activity of acetylcholinesterase in erythrocytes to be ascribed to the irradiation could be demonstrated during the first two days. A routine method for determination of the cholinesterase activities has been tested but is found less suitable as a diagnostic tool for the early recognition of the effects of irradiation. (auth)

2633

STEROL SYNTHESIS AFTER WHOLE BODY ROENTGEN IRRADIATION. H. K. Hanel, G. Hjort, G. Johansen, and P. R. Purser (Radium Centre, Copenhagen, Denmark). Acta Radiol. 48, 227-38(1957) Sept.

Male rats were irradiated with 400 r whole body irradiation. The in vivo incorporation of 2-C^{14}-acetate in liver cholesterol decreases during the first day after irradiation and subsequently increases. The hepatic cholesterol concentration falls immediately, rises above normal and slowly falls again. Histology shows no change in cell population. Total radioactivity incorporated in liver tissue, as shown by autoradiographs reaches a maximum at 1 day after irradiation. Incubation of rat liver slices with 2-C^{14}-acetate shows an increase in the metabolism of acetate to carbon dioxide, and an initial increase followed by a fall in the synthesis of digitonine-precipitable sterols from acetate. (auth)

2634

TREATMENT OF MALIGNANT BLOOD DISEASES BY RADIOACTIVE PHOSPHORUS. PART II. HEMATOLOGICAL ASPECTS. Ingmar Bergström. Acta Radiol., Suppl. 150, Part II, 1-98(1957).

Changes in the bone marrow picture and in the blood picture observed during P^{32} treatment of malignant blood diseases are reported. 41 references. (C.H.)

2635

FRACTIONATED DOSE EFFECTS ON SURVIVAL AND ORGAN WEIGHTS IN X-IRRADIATED MICE. J. G. Kereiakes, W. H. Parr, and A. T. Krebs (U. S. Army Medical Research Lab., Fort Knox, Ky.). Am. J. Physiol. 191, 131-4(1957) Oct.

2636

THE EFFECT OF IONIZING RADIATIONS ON THE REGENERATION AND BEHAVIOR OF MAMMALIAN LYMPHATICS. IN VIVO STUDIES IN SANDISON CLARK CHAMBERS. H. A. S. Van Den Brenk (Royal Coll. of Surgeons of Eng.). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 837-49(1957) Nov.

Observations are reported in vivo on the regeneration and behavior of lymphatics in repair tissue in the rabbit following the administration of ionizing radiations. (auth)

2637

THE EFFECT OF IRRADIATING THE EXTERIORIZED SMALL BOWEL ON SUGAR ABSORPTION. William T. Moss (Northwestern Univ. and Veterans Administration Research Hospital, Chicago, Ill.). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 850-4(1957) Nov.

Irradiation of the exteriorized small bowel prolongs gastric emptying. It also decreases the rate of glucose and arabinose absorption from the small bowel but absorption of the glucose is influenced more severely. This suggests that phosphorylation is disturbed as well as the process of diffusion. However, the magnitude of the change in the absorption of both sugars suggests that a decrease in the rate of diffusion is the major factor. (auth)

2638

EXTERNAL IRRADIATION OF THE THYROID GLAND IN DOGS. EFFECTS OF LARGE DOSES OF ROENTGEN RAYS UPON HISTOLOGIC STRUCTURE AND I^{131} METABOLISM. Paul M. St. Aubin, Ralph M. Kniseley, and Gould A. Andrews (Oak Ridge Inst. of Nuclear Studies, Tenn.). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 864-75(1957) Nov.

2639

HEMATOLOGIC RECOVERY OF ADULT AND WEANLING RATS FOLLOWING WHOLE BODY ROENTGEN IRRADIATION. Roberts Rugh and Joan Wolff (Columbia Univ., New York). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 887-900(1957) Nov.

2640

THE EFFECT OF TOTAL-BODY IRRADIATION ON CATABOLISM OF UREA IN THE RAT. John H. Rust, Willard J. Visek, and Lloyd J. Roth (Univ. of Chicago, Ill.). Arch. Biochem. Biophys. 72, 189-93(1957).

2641

THE DEVELOPMENT OF RADIATION AFTER-EFFECTS. G. G. Polikarpov (Moscow State Univ.). Biophysics 2, 176-9(1957).

2642

CERTAIN IRREGULARITIES IN THE GROWTH OF MACROCOLONIES AFTER IRRADIATION OF YEAST CELLS WITH GAMMA RAYS FROM RADIO-COBALT. V. I. Korogodin (Moscow State Univ.). Biophysics 2, 180-8(1957).

2643

EFFECT OF X-RAYS ON THE PERMEABILITIES OF BLOOD-ORGAN BARRIERS. L. S. Shtern, C. Ia. Rapoport, M. M. Gromakovskaia, and S. R. Zubkova (Academy of Sciences of the USSR, Moscow). Biophysics 2, 188-97 (1957).

2644

USE OF IONIZING RADIATION AGAINST PESTS OF STORED GRAIN. A. A. Peredel'skii, P. D. Rumiantsev, A. V. Bibergalv, L. Z. Rodionova, and E. S. Pertsovskii (Academy of Sciences of the USSR and All-Union Grain Research Inst., Moscow). Biophysics 2, 209-13(1957).

2645

THE MECHANISM OF DEATH FOLLOWING WHOLE BODY RADIATION. Edith Paterson (Christie Hospital and Holt Radium Inst., Withington, Manchester). Brit. J. Radiol. 30, 577-81(1957) Nov.

During the period of the radiation syndrome, the changes in the blood, however dramatic, are probably not basic to the mechanism of death, but are an inevitable secondary consequence. Death, at the critical stage, may be precipitated by hemorrhage or anoxia, or by the occurrence of bacteremia. The prime cause of death must surely be the exhaustion of one or more stem cell types from the reticulum. Individual differences in quality or quantity of this cell factor determine the individual sensitivity of the subject. Hibernation will postpone, but not prevent, the train of events. But replacement of this factor sufficiently early in the post-irradiation period can prevent the diverse changes. It would seem to be of the utmost importance to find the function or the identity of this cell type. This would not only give us a real understanding of the mechanism and treatment of total body irradiation, but might also enable us to understand some of those diseases of the reticuloendothelial system in which bone marrow failure is a characteristic termination. (auth)

2646

THE EFFECT OF OXYGEN ON THE RADIOSENSITIVITY OF GROWING BONE IN THE TAIL OF THE MOUSE. P. Howard-Flanders and E. A. Wright (Hammersmith Hospital, London). Brit. J. Radiol. 30, 593-9(1957) Nov.

2647

A REVIEW WITH SPECIAL REFERENCE TO RADIATION TUMOURS IN THE PHARYNX, LARYNX, AND THYROID. A. W. G. Goolden (Hammersmith Hospital, London). Brit. J. Radiol. 30, 626-40(1957) Dec.

Twenty-four cases of radiation cancer in the deep tissues of the neck have been recorded in the literature; of these 18 have developed in the pharynx, five in the larynx, and one in the thyroid. A further 18 cases of radiation cancer of the pharynx are reported here. (auth)

2648

IONIZING RADIATION AND THE SOCIALLY HANDICAPPED. T. C. Carter (Medical Research Council's Radiobiological Research Unit. Harwell, Berkshire, Eng.). Brit. J. Radiol. 30, 641-47(1957) Dec.

2649

THE EFFECTS OF RADIATION ON EXTRACTION-WOUND HEALING IN THE RAT. Murray Stein, Luther W. Brady, and Antolin Raventos (Univ. of Pennsylvania School of Medicine, Philadelphia). Cancer 10, 1167-81(1957) Nov.-Dec.

2650

STUDIES ON THE MECHANISM OF ACQUIRED RADIORESISTANCE IN CANCER. Alan D. Conger and Helen J. Luippold (Oak Ridge National Lab., Tenn.). Cancer Research 17, 897-903(1957) Oct.

The problem of the mechanism by which radioresistance of a tumor can be acquired is examined. Three hypotheses to explain the phenomenon are commonly proposed; namely, radiation selection of spontaneous mutant resistant cells in the tumor population, radiation-induced mutation in a tumor cell to resistance, followed by selection; and a complex of radiation effects on the host that interact with the tumor to give the appearance of resistance to the tumor. An experiment with mouse ascites tumor, specifically designed to maximize the likelihood of producing a true, or genetically, radioresistant tumor line is described; radioresistance was not produced. (auth)

2651

HISTOPATHOLOGY OF THE EFFECT OF CORTISONE ON THE IRRADIATED RAT LUNG. Charles C. Berdjis and Reynold F. Brown (Univ. of California School of Medicine, San Francisco). Diseases of the Chest 32, No. 5, 12p. (1957) Nov.

2652

X RADIATION EFFECTS ON THE CORRELATIVE VARIATIONS IN PLANTS. I. M. Vasil'ev (Inst. of Biophysics, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 116, 49-51(1957) Sept. 1. (In Russian)

2653

ANALYSIS OF RADIATION DAMAGE TO THE EYE CORNEA. T. V. Krestinskaya (Pavlov First Leningrad Medical Inst.). Doklady Akad. Nauk S.S.S.R. 116, 52-5 (1957) Sept. 1. (In Russian)

2654

A COMPARISON OF THE CARCINOGENIC EFFECT OF INTERNAL AND EXTERNAL IRRADIATION ON THE THY-

ROID GLAND OF THE MALE LONG-EVANS RAT. Virginia Kneeland Frantz, Morton M. Kligerman, W. Arthur Harland, Mildred E. Phillips, and Edith H. Quimby (Columbia Univ., New York). Endocrinology 61, 574-81(1957) Nov.

2655

A METHOD FOR TREATING WHEAT POLLEN WITH ULTRAVIOLET RADIATION FOR GENETIC EXPERIMENTS. A. C. Fabergé (Oak Ridge National Lab., Tenn.). Genetics 42, 618-22(1957) Sept.

A method for treating wheat pollen with ultraviolet radiation, for genetic experiments is described. The construction of a special bolometer for measuring incident radiation falling from all directions, which was used for estimating the dose delivered to the pollen, is discussed. (auth)

2656

ULTRAVIOLET AND X-RAY INDUCED CHROMOSOMAL ABERRATIONS IN WHEAT. Lotti M. Steintz-Sears and E. R. Sears (Univ. of Missouri, Columbia). Genetics 42, 623-30(1957) Sept.

From wheat pollen given dosages of ultraviolet and x rays roughly comparable in capacity to break chromosomes, 56 and 124 plants, respectively, were obtained, all of which were analyzed cytologically. Reciprocal translocations and part- and whole-chromosome deficiencies were found following both types of treatment, but more of the ultraviolet translocations were deficient for an apparently terminal segment. This is regarded as evidence for less reunion and more healing of broken chromosomes following ultraviolet treatment. The virtual absence of translocations in previous ultraviolet experiments is attributed to the strong tendency of ultraviolet-induced translocations to involve deficiency. In diploid species these deficiencies would frequently cause inviability. The data suggest also that dicentric chromosomes are seldom lost in this material, but instead often break and give rise to chromosomes with terminal deficiencies. (auth)

2657

INDUCED CHANGES IN FEMALE GERM CELLS OF DROSOPHILA. V. THE CONTRIBUTION OF HALF-TRANSLOCATION AND NONDISJUNCTION TO THE DOMINANT LETHALITY INDUCED BY X-RAYING OOCYTES. Irwin H. Herskowitz and Abraham Schalet (Indiana Univ., Bloomington). Genetics 42, 649-60(1957) Sept.

2658

RADIATION RESISTANCE AND GENETIC SEGREGATION IN A LARGE CELL POSSIBLY POLYPLOID STRAIN OF ESCHERICHIA COLI. M. R. Zelle and James E. Ogg (Cornell Univ., Ithaca, N. Y.). J. Bacteriol. 74, 485-93 (1957) Oct.

Comparative tests were made of the resistance to radiation of Escherichia coli strain 82/r and a stable, large cell, possibly polyploid derivative, P6, produced by exposure of 82/r to camphor vapors. P6 was markedly more resistant to x rays, γ rays and ultraviolet. (auth)

2659

PRINCIPLES AND METHODS OF APPLICATION OF A ROTATORY TELETHERAPY APPARATUS USING RADIO-COBALT. Paul Desaive, Julien Garsou, and Roger Ghys. J. belge radiol. 40, 442-543(1957). (In French)

2660

FURTHER MEASUREMENTS WITH THE LEIDEN TELE-COBALT UNIT. J. H. Mellink. J. belge radiol. 40, 544-63(1957).

2661

CAN RADIATION CAUSE THYROID CANCER? B. J. Duffy, Jr. (Georgetown Univ. Hospital, Washington). J. Clin. Endocrinol. and Metabolism 17, 1383-8(1957) Nov.

2662

CYTOLOGIC CHANGES IN THE MOUSE INTESTINE UNDER DAILY EXPOSURE TO GAMMA RAYS. S. Lesher (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 19, 419-49(1957) Sept.

2663

REPOPULATION OF HEMATOPOIETIC TISSUES AND BLOOD IN LETHALLY X-IRRADIATED MICE BY HOMOLOGOUS BONE-MARROW CELLS. Ruth M. Merwin and Charles C. Congdon (National Cancer Inst., Bethesda, Md. and Oak Ridge National Lab., Tenn.). J. Natl. Cancer Inst. 19, 875-84(1957) Nov.

2664

INFLUENCE OF TOTAL BODY X-IRRADIATION ON THE LEVELS OF CREATINE PHOSPHATE, INORGANIC PHOSPHORUS AND ATP IN MUSCLE AND ON THE LEVELS OF CREATINE, CREATININE, N'-METHYL-NICOTINAMIDE AND NITROGEN IN URINE. U. S. Kumta, S. U. Gurnani, and M. B. Sahasrabudhe (Atomic Energy Establishment, Bombay). J. Sci. Ind. Research (India) 16C, 179-81(1957) Sept.

The influence of total-body irradiation on the levels of creatine phosphate (CP), adenosine triphosphate (ATP) and inorganic phosphorus (IP) in muscle has been investigated in rats. CP and ATP levels decrease by about 33% while those of IP increase 4 times in irradiated rats. Studies on the influence of irradiation on the excretion of creatine, creatinine, and N'-methyl-nicotinamide in urine show that the excretion of creatine and N'-methyl-nicotinamide is increased two-fold while that of creatinine is increased by 160%. It is suggested that the low levels of creatine phosphate are probably due to an impairment in the phosphorylation of creatine or due to an adaptive breakdown of creatine phosphate leading to increased excretion of creatine and creatinine. (auth)

2665

EFFECT OF GAMMA RAYS ON THE SPROUTING OF STORED MANGOLDS. C. E. Cornford (Rothamsted Field Station, Dunholme, Lincoln) and D. B. Powell (Atomic Energy Research Establishment, Grove, Nr. Wantage, Berks). Nature 180, 996(1957) Nov. 9.

2666

BIOLOGICAL RESPONSE TO MIXED RADIATIONS. Daniel S. Grosch, Robert L. Sullivan, and Leo E. LaChance (Marine Biological Lab., Woods Hole, Mass. and North Carolina State Coll., Raleigh). Nucleonics 15, No. 12, 64, 66(1957) Dec.

In reactor and certain accelerator situations radiation is often present as a mixture of radiations. To study the additive effects of such mixtures, a series of experiments was made on the combined sterilizing effects of external x rays and ingested β emitters (P^{32} and Sr^{89}) on the ectoparastic wasp, Habrobracon juglandis. (L.T.W.)

2667

SURVIVAL OF LABELED PLATELETS IN X-IRRADIATED RABBITS. Edward H. Reisner, Jr. and Richard P. Keating (St. Luke's Hospital, New York). Proc. Soc. Exptl. Biol. Med. 96, 112-14(1957) Oct.

2668

CONDITIONING OF THE MOUSE FETUS AGAINST X-IRRADIATION DEATH. Roberts Rugh and Joan Wolff (Columbia Univ., New York). Proc. Soc. Exptl. Biol. Med. 96, 178-9(1957) Oct.

2669

EFFECT OF NITROGEN AND HYDROGEN GAS UNDER PRESSURE ON THE RADIOSENSITIVITY OF THE BROAD BEAN ROOT. Michael Ebert and Alma Howard (Hammer-

smith Hospital, London and Mount Vernon Hospital and Radium Inst., Northwood, Middlesex, Eng.). Radiation Research 7, 331-41(1957) Oct.

2670

THE EFFECT OF BREATHING OXYGEN ON THE RADIOSENSITIVITY OF THE RABBIT LENS AND USE OF OXYGEN IN X-RAY THERAPY. P. Howard-Flanders and Antionette Pirie (Hammersmith Hospital, London, and Nuffield Lab. of Ophthalmology, Oxford, Eng.). Radiation Research 7, 357-64(1957) Oct.

2671

NERVOUS CONTROL OF THE REACTION OF ANTERIOR HYPOPHYSIS TO X-IRRADIATION AS STUDIED IN GRAFTED AND NEWBORN RATS. Z. M. Bacq, P. Martinovitch, P. Fischer, M. Pavlovitch, D. S. Sladitch, and D. V. Radivojevitch. Radiation Research 7, 373-85(1957) Oct.

2672

EVIDENCE FOR RECOVERY FROM X-RAY DAMAGE IN CHLAMYDOMONAS. Baruch S. Jacobson (Univ. of California, Berkeley). Radiation Research 7, 394-406 (1957) Oct.

2673

LATE EFFECTS OF WHOLE-BODY X-IRRADIATION IN THE MOUSE. SOME GROSS AND HISTOLOGICAL ASPECTS OF THE DEVELOPMENT OF MORBIDITY PRIOR TO THE TERMINAL STATE, WITH SPECIAL REFERENCE TO THE GONAD, UTERUS, HEART, LIVER, KIDNEY, AND SUBMAXIALLARY GLAND. Henry I. Kohn, Robert F. Kallman, and Charles C. Berdjis (Univ. of California School of Medicine, San Francisco and Kenneth B. De Ome (Univ. of California, Berkeley). Radiation Research 7, 407-35(1957) Oct.

2674

RADIATION SENSITIVITY OF ENZYMES IN WET AND IN DRY YEAST CELLS. Franklin Hutchinson, Angela Preston, and Beatrice Vogel (Yale Univ., New Haven, Conn.). Radiation Research 7, 465-72(1957) Nov.

2675

THE DISTANCE THAT A RADICAL FORMED BY IONIZING RADIATION CAN DIFFUSE IN A YEAST CELL. Franklin Hutchinson (Yale Univ., New Haven, Conn.). Radiation Research 7, 473-83(1957) Nov.

2676

ALPHA-PARTICLE BOMBARDMENT OF THE HABROBRACON EGG. I. SENSITIVITY OF THE NUCLEUS. R. W. Rogers and R. C. Von Borstel (Oak Ridge National Lab., Tenn. and Florida State Univ., Tallahassee). Radiation Research 7, 484-90(1957) Nov.

2677

THE PREVENTION OF PSEUDOMONAS AERUGINOSA INFECTIONS IN IRRADIATED MICE AND RATS. F. Wensinck, D. W. Van Bekkum, and H. Renaud (National Defence Research Council T.N.O., Rijswijk, Netherlands). Radiation Research 7, 491-9(1957) Nov.

2678

THE EXPERIMENTAL EFFECT OF X-RADIATION AND CORTISONE ON SERUM PROTEINS. Alvar A. Werder, Creighton A. Hardin, and Perry Morgan (Univ. of Kansas School of Medicine, Kansas City). Radiation Research 7, 500-7(1957) Nov.

2679

THE SENSITIVITY OF MICROORGANISMS TO IRRADIATION UNDER CONTROLLED GAS CONDITIONS. P. Howard-Flanders and Tikvah Alper (Hammersmith Hospital, London). Radiation Research 7, 518-40(1957) Nov.

2680

THE EFFECTS OF IRRADIATION WITH PHOSPHORUS-32 ON THE VIABILITY AND GROWTH OF RAT EMBRYOS. Melvin R. Sikov and Thomas R. Noonan (Univ. of Rochester, N. Y.). Radiation Research 7, 541-50(1957) Nov.

2681

GAMMA-RADIATION AND LONGEVITY OF THE FLOUR BEETLE. J. M. Cork (Univ. of Michigan, Ann Arbor). Radiation Research 7, 551-7(1957) Dec.

2682

PERIPHERAL BLOOD OF THE X-IRRADIATED RHESUS MONKEY. A. J. Riopelle, H. W. Ades, and F. E. Morgan, Jr. (Emory Univ., Ga.). Radiation Research 7, 581-90 (1957) Dec.

2683

THE RADIOTOXIC EFFECTS OF S^{35} IN GROWING CARTILAGE. CONSIDERATION OF RADIOACTIVE SULFUR (S^{35}) AS A POSSIBLE RADIOTHERAPEUTIC AGENT IN CHONDROSARCOMAS. Philip Rubin, Kirkland C. Brace, Hazel Gump, Richard Swarm, and J. Robert Andrews (National Cancer Inst. and Dept. of Health, Education, and Welfare, Bethesda, Md.). Radiology 69, 711-19(1957) Nov.

2684

THE GENETIC HAZARDS OF NUCLEAR RADIATIONS. Bentley Glass (Johns Hopkins Univ., Baltimore, Md.). Science 126, 241-6(1957) Aug. 9.

Present concepts of the nature of mutations are reviewed. The role of radiation in inducing permanent alterations of hereditary material and the nature of these changes are discussed. (C.H.)

2685

X-RAY INDUCED CHROMOSOME ABERRATIONS IN NORMAL DIPLOID HUMAN TISSUE CULTURES. Michael A. Bender (Johns Hopkins Univ., Baltimore, Md.). Science 126, 974-5(1957) Nov. 8.

The aberrations in cultured epitheloid diploid human kidney cells after treatment with x rays are tabulated. Aberration counts were made on material fixed 42, 49, and 72 hours after treatment. Control material fixed at each interval was also examined. Two doses, 25 and 50 r, were used. (M.H.R.)

2686

ATOMIC ENERGY AND AGRICULTURE. C. L. Comar, ed. Washington, American Association for the Advancement of Science, 1957. 459p.

Topics discussed include tracer studies on soil-plant relations; tracer studies on plant metabolism; crop improvement based on response of biological systems to ionizing radiations; applications of radiation effects and radioisotopes in various aspects of agricultural entomology including work with insects and insecticides; applications of radioisotopes in studies on animal nutrition and metabolism; and the feasibility of food preservation by irradiation. 1035 references. (C.H.)

2687

BASIC MECHANISMS IN RADIOBIOLOGY. V. MAMMALIAN ASPECTS. PROCEEDINGS OF AN INFORMAL CONFERENCE, HIGHLAND PARK, ILLINOIS, May 14–16, 1956. NUCLEAR SCIENCE SERIES REPORT NUMBER 21. PUBLICATION NUMBER 513. Howard J. Curtis and Henry Quastler, eds. Washington, National Academy of Sciences-National Research Council, 1957. 209p.

The effects of radiation on mammals are discussed. Both chronic and acute effects are considered. Topics discussed include the radiosensitivity of cells; carcinogenesis;

the effects of irradiation on life-span in mammals; and the mechanisms of action of radiation in mammalian systems. (C.H.)

2688

EFFECT OF RADIATION ON HUMAN HEREDITY. Geneva, World Health Organization, 1957. 168p. $4.00.

The findings of a study group on the effect of radiation on human heredity are summarized. The group recommends the establishment of institutions and departments devoted to general genetics and human genetics. A registry of serious hereditary diseases and defects in various populations is suggested. It is pointed out that there is evidence that damage to body tissues produced by radiation after relatively small doses is, at least in part, mediated through effects on genes and chromosomes. There is also evidence that the life-span may be reduced in mammals even by relatively small radiation doses. The genetic hazards of man-made radiation from sources used in medicine, industry, commerce, and experimental science is stressed. The importance of reducing radiation exposures and shielding the gonads is emphasized. It is suggested that as both an approach to control and as a means of providing basic background information for relating quantitatively radiation exposure and effects on man, it is essential that methods be found of recording exposures to individuals and populations. Individual papers presented at the meeting of the study group are included. (C.H.)

2689

PROCEEDINGS OF NINTH OAK RIDGE REGIONAL SYMPOSIUM. "RADIATION IN PLANT BREEDING." Oak Ridge, Oak Ridge Institute of Nuclear Studies, 1957. 70p.

The present status of research programs in the application of radioactivity to plant breeding is reviewed. Gamma radiation fields for use in the irradiation of plants are described. Findings are summarized from studies on radioinduced mutations in plants and the various factors affecting the genetic effects of radiation on plants. 47 references. (C.H.)

2690

THE FUTURE OF FOOD PRESERVATION. PROCEEDINGS OF A SYMPOSIUM, APRIL 2-3, 1957, KANSAS CITY, MISSOURI. Sarah C. Lechtman and Odom Fanning, eds. Kansas City, Midwest Research Institute, 1957. 189p. $6.00.

Various procedures for the preservation of foods are discussed. Applications of atomic energy in food processing are included. (C.H.)

Radiation Hazards and Protection

2691 KAPL-M-DWJ-6

Knolls Atomic Power Lab., Schenectady, N. Y.

CONTAINMENT OF AIRBORNE RADIOACTIVE CONTAMINANTS IN THE EVENT OF SMALL PRIMARY COOLANT LEAKS. David W. Johnson. [May 1956]. 47p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30 (mf OTS).

The effectiveness of different degrees of airtightness of the Submarine Advanced Reactor secondary shield in limiting airborne radioactive contamination as a result of leaks in the primary coolant system is discussed. (auth)

2692 NP-6491

Chicago. Univ. Air Force Radiation Lab.

QUARTERLY PROGRESS REPORT NO. 25. Oct. 15, 1957. 129p. Contract AF-41(657)-25.

Data are presented on the survival time, weight loss, and mortality of mice treated with 70 chemical compounds immediately prior to the administration of a lethal dose of whole-body x radiation. Marked protective effects were observed following the pre-irradiation intraperitoneal administration of dimethyldithiocarbamic acid dimethylammonium salt, diethyldithiocarbamic acid diethylammonium salt, 2-aminoethanol, dithiol, monothiohydroquinone, and furfuryl mercaptan. Significant although lesser protective effects were seen following the administration of various doses of some of the other chemicals tested. Exposure of rats to fast neutron irradiation at a dose rate of 3.5 rep/hr caused a dose-dependent increase in adenosine triphosphatase activity of the spleens and thymus glands throughout the range of 79 to 350 rep. A similar relationship between dose and enzyme alteration was noted after γ radiation under the same conditions of exposure in the dose range from 300 to 500 rep. Sublethal doses of fast neutron and Co^{60} γ irradiation were found to have effects qualitatively similar to x irradiation in depressing the endogenous respiration of spleen and thymus tissues of rats and these effects were found to be entirely reversible during a 14-day period. Data are included from studies on the effect of various steroids on the survival of x irradiated mice, studies on the antagonistic action of aminethylisothiuronium dichloride on the hyperglycemia induced by thiourea derivatives, and studies on the influence of fractionated exposures to low levels of γ and fast neutron irradiation on the mortality, survival time, and weight changes in mice. (For preceding period see NP-6398.) (C.H.)

2693 ORNL-2384

Oak Ridge National Lab., Tenn.

HEALTH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1957. Nov. 26, 1957. 131p. $3.50(OTS).

Progress is reported in the following studies: the construction of a body burden counter which employs activation analysis to measure directly U^{235} injected in rats and mice; the tissue distribution of U^{233} in mice following ingestion of 0.12 μc/day in drinking water for periods of from 30 to 120 days; the testing of an atmosphere exposure chamber; the tissue distribution of U in dogs following inhalation of uranium fumes or the ingestion of uranium oxides; development of a procedure for the radiometric determination of U in urine following ion exchange separation as a uranyl chloride complex; radiobiological-ecological studies on the drained bed of White Oak Lake, an impoundment used as a holdup basin for low-level radioactive wastes; the development of procedures for use in the collection of arthropods and insects; the effects of irradiation on population growth of Collembola, Coleoptera, and Caloglyphus; the uptake of fission product waste seepage by trees and smaller vegetation; a review of data on maximum permissible concentrations of radioisotopes for the human body; the tissue distribution of Sr^{90} and Y^{90} in mice; the spectrographic analysis of human tissues for trace elements; the performance of an aerosol generator for dispersing U aerosols; the development of radiochemical methods for the determination of trace amounts of fission products in water and soil samples; investigations of waste processing by evaporation, storage in deep wells and waste pits, adsorption on soil columns; solvent extraction, and sintering; assays of the soil movement and dilution of wastes from storage pits; and a survey of possible waste disposal sites. A review is presented of the Ichiban Project for the determination of the absorbed doses of fast neutrons and γ radiation received by survivors of the nuclear bombing of Hiroshima and Nagasaki. Data are included from a preliminary study of γ attenuation by Japanese house components. Applications of the information theory in studies of radioinduced tissue damage are discussed. A quantum theory for the dielectric

constant of metals is presented and discussed. A procedure is described for the preparation of thin uniform sources for a beta-ray spectrometer. Studies on the theoretical physics of radiation dosimetry and the development of instruments for use as dosimeters are reported. Education, training, and consultation activities during the period are reported, and a list of publications during the period is included. (For preceding period see ORNL-2151.) (C.H.)

2694

RECENT CHANGES IN MAXIMUM PERMISSIBLE EXPOSURE VALUES. K. Z. Morgan (Oak Ridge National Lab., Tenn.). Arch. Ind. Health 16, 357-62(1957) Nov.

In April, 1956, the International Committee on Radiological Protection adopted the maximum permissible integrated absorbed dose as 50 rem to age 30 or 50 rem per decade thereafter. The National Committee on Radiation Protection set the maximum absorbed dose that could be accumulated from occupational exposure at 5(A-18) rem, in which A is the age in years of the occupationally exposed person. The effect of this standard on the others is evaluated and the reasoning and experience which led to these standards are discussed. (M.H.R.)

2695

RADIATION DOSE TO STAFF IN MEDICAL X-RAY DEPARTMENTS. G. M. Ardran, H. E. Crooks, F. H. Kemp, and R. Oliver (Atomic Energy Research Establishment, Harwell). Brit. J. Radiol. 30, 600-1(1957) Nov.

2696

MORTALITY OF MICE AS AFFECTED BY VARIATION OF THE X-RAY DOSE AND NUMBER OF NUCLEATED RAT BONE MARROW CELLS INJECTED. N. Gengozian and T. Makinodan (Oak Ridge National Lab., Tenn.). Cancer Research 17, 970-5(1957) Nov.

2697

CHEMICAL PROTECTION AGAINST X-RAY DAMAGE TO CHROMOSOMES. Herbert Parkes Riley (Oak Ridge National Lab., Tenn.). Genetics 42, 593-600(1957) Sept.

Onion root tips were treated with x-rays while immersed in water or in various chemical compounds. The effect of the radiation was determined from the frequency of chromosome interchanges or deletions or of anaphase bridges. Protection against the formation of interchanges and deletions was conferred by 4×10^{-3} M sodium sulfhydrate, sodium thiosulfate, sodium hydrosulfate, and sodium pyrosulfate, and 1.7 M ethanol but not by 2.8×10^{-1} glucose or 4×10^{-3} M sodium peroxydisulfate and uracil or by 2×10^{-3} M sodium bisulfite, sodium bisulfate, and tryptophan. Protection against deletions but not significantly against interchanges was conferred by 4×10^{-3} M sodium metabisulfite, cysteine, and cystine. Protection against anaphase bridges was given by 4×10^{-4} M cysteine and cystine but not by sodium bisulfite or sodium bisulfate. When primary roots less than 1 cm long from freshly germinated seeds were irradiated in water, they showed fewer chromosomal interchanges and deletions and fewer anaphase bridges than did root tips from bulbs. Roots from older seedlings about 8 cm long had fewer interchanges and deletions than roots from bulbs but more than young roots from seeds. There seems to be some inherent protection against radiation in freshly germinated seeds that disappears as the roots get older. (auth)

2698

POSTIRRADIATION MODIFICATION OF MUTAGENESIS IN PARAMECIUM BY STREPTOMYCIN. R. F. Kimball, Nenita Gaither, and Stella M. Wilson (Oak Ridge National Lab., Tenn.). Genetics 42, 661-9(1957) Sept.

2699

M. W. KELLOGG CO. RADIATION INCIDENT ON MARCH 13, 1957. Nucleonics 15, No. 12, 42-3(1957) Dec.

This statement by the General Manager of the AEC concerns the background and facts relating to an incident involving the uncontrolled release of radioactive Ir^{192} at the South Houston plant of the Nuclear Products Div. of the M. W. Kellogg Co. in March 1957. (L.T.W.)

2700

INDUCED TOLERANCE AND "HOMOLOGOUS DISEASE" IN X-IRRADIATED MICE PROTECTED WITH HOMOLOGOUS BONE MARROW. J. J. Trentin (Baylor Univ. Coll. of Medicine and Univ. of Texas Dental Branch, Houston). Proc. Soc. Exptl. Biol. Med. 96, 139-44(1957) Oct.

2701

THE ACTION OF VARIOUS DRUGS ON THE SUPRARENAL RESPONSE OF THE RAT TO TOTAL-BODY X-IRRADIATION. Z. M. Bacq and P. Fischer (Univ. of Liège, Belgium). Radiation Research 7, 365-72(1957) Oct.

A chemical protector, cysteamine (100 mg/kg intraperitoneally), inhibits the second irreversible drop in cholesterol and ascorbic acid which, in the controls, begins on the second day after a total-body exposure of rats to 800 r of x rays (250 kv). Morphine (20 mg/kg) preceded by Nembutal (20 mg/kg) is known to inhibit the hypothalamo-pituitary-adrenal response to stress. This pharmacological treatment prior to total-body irradiation prevents any change in ascorbic acid and cholesterol values in the rat's suprarenal during the first 24 hours after irradiation, but it does not decrease the mortality, and does not change the profound depression of these two values at the third day after irradiation, even if a morphine injection (40 mg/kg) is given daily. It is suggested that the first reversible reaction (during the 24 hours after irradiation) is a simple reaction to the physical stimulus of irradiation acting as a stress. The significance of the second reaction is not so clear because it happens at the third or fourth day when the general condition of the irradiated rat deteriorates. (auth)

2702

DETECTION OF MANGANESE-54 IN RADIOACTIVE FALLOUT. William H. Shipman, Philip Simone, and Herbert V. Weiss (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Science 126, 971-2(1957) Nov. 8.

The chemical separation and γ spectral analysis of Mn are described. The γ spectra before and after separation are graphed. The samples were collected during the 1956 Eniwetok nuclear tests. (M.H.R.)

2703

PROTECTION OF GUINEA PIGS AGAINST RADIATION DEATH BY CELL-FREE MOUSE SPLEEN EXTRACT. F. Ellinger (Naval Medical Research Inst., Bethesda, Md.). Science 126, 1179-80(1957) Dec. 6.

2704

A HANDBOOK ON RADIATION AND PROTECTION. N. G. Gusev. State Publishers of Medical Literature, Moscow, 1956. 127p. (In Russian)

Data are given on the physical properties of radioactive materials and on the dosage determination in U.S.S.R., as well as the universal measuremert tables and complete tables of γ constants for radioactive elements. Corrections are given for the data on half-value layers for β particles and on γ ray self-absorption in cylindrical sources. The handbook is designed for the use of engineers and medical personnel working with radioactive materials. (R.V.J.)

Radiation Sickness

2705
REGENERATIVE PROCESSES IN BONE MARROW BLOOD FORMATION IN ACUTE RADIATION SICKNESS. E. V. Shamshina, N. V. Nikolaeva, and B. F. Beliaeva (Ministry of Health, U.S.S.R.). Problems of Hematology and Blood Transfusion 2, 86-92(1957).

2706
PATHOGENESIS OF RADIATION SICKNESS. S. D. Kalenova, A. Iu. Tilis, E. G. Tepliakova, V. I. Kaluzina, and G. S. Levin (Uzbek Blood Transfusion Research Inst.). Problems of Hematology and Blood Transfusion 2, 93-9 (1957).

Radiotherapy

2707
RADIATION HAZARDS DURING RADON TREATMENT OF EYE LESIONS. J. Cederlund, K. Lidén, and M. Lindgren (Univ. of Lund, Sweden). Acta Radiol. 48, 205-8(1957) Sept.

The radiation hazards of beta-ray treatment of eye lesions with a radon applicator were studied. A protective barrier producing a 90 per cent reduction in the gamma radiation received by the radiologist is described. (auth)

2708
EFFECTS OF RADIATION QUALITY, TARGET-AXIS DISTANCE, AND FIELD SIZE ON DOSE DISTRIBUTION IN ROTATION THERAPY. Edith H. Quimby and Beverly S. Cohen (Coll. of Physicians and Surgeons, New York). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 819-30(1957) Nov.

Calculated values of the ratio of maximum skin dose to axis dose in rotation therapy are presented for lesions in various positions in head, pelvis, and chest. Radiation qualities cover a range of copper half value layers from 1.0 to 15.0 mm., the last corresponding to the radiations from radioactive Co^{60}. Target-axis distances of 65 and 85 cm. are used for most problems, and 115 cm. for a few. A suitable range of field sizes is studied for each anatomic location. (auth)

2709
THE ENDOCRINE DEPENDENCY OF CERTAIN THYROID CANCERS AND THE DANGER THAT HYPOTHYROIDISM MAY STIMULATE THEIR GROWTH. George Crile, Jr. (Cleveland Clinic Foundation and Frank E. Bunts Educational Inst., Cleveland, Ohio). Cancer 10, 1119-37(1957) Nov.-Dec.

Thyroidectomy or treatment with I^{131} or thiouracil may stimulate the growth of well-differentiated thyroid cancers or may even convert them to anaplastic carcinomas. Probably it is not the radiation from the I^{131} but the secondary hypothyroidism and the increased output of thyroid-stimulating hormone (TSH) that stimulates the cancer. Desiccated thyroid in doses of 3 gr or more daily inhibits the production of thyrotropic hormone and often causes regression of differentiated thyroid cancers. Most inoperable thyroid cancers should not be treated by I^{131} until they have been given a trial on treatment with desiccated thyroid. All patients operated on for thyroid cancer should be given desiccated thyroid to prevent recurrences. (auth)

2710
RADIATION PNEUMONITIS AND FIBROSIS: A COMPLICATION OF RADIOIODINE TREATMENT OF PULMONARY METASTASES FROM CANCER OF THE THYROID. J. E. Rall, J. B. Alpers, C. G. Lewallen, M. Sonenberg, M. Berman, and R. W. Rawson (Sloan-Kettering Inst. for Cancer Research, New York). J. Clin. Endocrinol. and Metabolism 17, 1263-76(1957) Nov.

The course of cancer of the thyroid with pulmonary metastases treated with radioiodine has been reviewed in 15 cases. Two patients died from what was presumed to be radiation pneumonitis. In 4 other patients there was x-ray evidence of pulmonary fibrosis. Nine patients are still alive one and a half to eight years after I^{131} therapy of pulmonary metastases from carcinoma of the thyroid. (auth)

2711
PROGRESS AND POTENTIALITIES IN TELETHERAPY. Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Mississippi Valley Med. J. 79, 260-70(1957) Nov.

2712
ATOMIC ENERGY IN MEDICINE. K. E. Halnan. London, Butterworths Scientific Publications, 1957. 173p.

Applications of radioisotopes and particle accelerators in diagnosis and therapy are reviewed. 22 references. (C.H.)

Toxicology Studies

2713 AECU-3583
Utah. Univ., Salt Lake City. Radiobiology Lab.
SEMI-ANNUAL PROGRESS REPORT. Sept. 30, 1957. 129p. Contract AT(11-1)-119. $19.80(ph OTS); $6.30 (mf OTS).

Progress is reported in studies on the metabolism, radiation dose, radiation effects, and toxic effects of prolonged exposure of dogs following injection of various doses of Pu^{239}, Ra^{228}, Th^{228}, and Sr^{90}. An improved live dog gamma counter is described. (For preceding period see AECU-3522.) (C.H.)

2714 AERE-Med/M-18
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME NOTES ON INDIUM—WITH SPECIAL REFERENCE TO ITS TOXIC PROPERTIES. Frances M. Turner. Aug. 1957. 4p.

2715 ANL-5689
Argonne National Lab., Lemont, Ill.
RETENTION AND ELIMINATION OF RADIUM ISOTOPES PRODUCED BY THE DECAY OF THORIUM PARENTS WITHIN THE BODY—CALCULATIONS AND COMPARISON WITH EXPERIMENTAL FINDINGS. John C. Reynolds, Philip F. Gustafson, and Leonidas D. Marinelli. Nov. 1957. 43p. Contract W-31-109-eng-38. $1.25(OTS).

2716
GAS-MASK PROTECTION AGAINST DIBORANE, PENTABORANE, AND MIXTURES OF BORANES. James E. Long, George J. Levinskas, and William H. Hill (Univ. of Pittsburgh) and Joseph L. Svirbely (Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio). Arch. Ind. Health 16, 393-402(1957) Nov.

Candidate materials were screened as to their efficiency for removing boranes from contaminated air streams. Chemical tests and animal exposure studies were done. The results show that the following give temporary protection against: diborane—chemical cartridge respirator charged with Hopcalite; pentaborane—chemical cartridge respirator charged with activated C; pentaborane and decaborane—filler medium of silica gel and activated C; and diborane, pentaborane, and decaborane—silica gel, active Hopcalite, and activated C. (M.H.R.)

2717
ACUTE TOXICITY OF YTTRIUM, LANTHANUM, AND OTHER RARE EARTHS. Granvil C. Kyker and Edgar A. Cress (Oak Ridge Inst. of Nuclear Studies, Tenn.). Arch. Ind. Health 16, 475-9(1957) Dec.

2718
NICKEL POISONING. IV. CHRONIC EXPOSURE OF RATS TO NICKEL CARBONYL; A REPORT AFTER ONE YEAR OBSERVATION. F. William Sunderman, John F. Kincaid, Andrew J. Donnelly, and Bob West (Jefferson Medical Coll.; Rohm and Haas Co.; and Inst. for Cancer Research, Philadelphia, Penna.). Arch. Ind. Health 16, 480-5(1957) Dec.

2719
NICKEL POISONING. V. THE METABOLISM OF NICKEL UNDER NORMAL CONDITIONS AND AFTER EXPOSURE TO NICKEL CARBONYL. Ralph E. Tedeschi and F. William Sunderman (Jefferson Medical Coll., Philadelphia, Penna.). Arch. Ind. Health 16, 486-8(1957) Dec.

2720
BORON HYDRIDE (BORANE) INTOXICATION IN MAN. Harry J. Lowe and Gustave Freeman (National Cancer Inst., Bethesda, Md. and Army Chemical Center, Md.). Arch. Ind. Health 16, 523-33(1957) Dec.

2721
THE AIR POLLUTION BIBLIOGRAPHY. VOLUME I. Jack R. Gibson, Wave E. Culver, and Mary E. Kurz. Washington, Library of Congress, 1957. 155p.

This bibliography consists of 750 references on the administrative, economic, engineering, legal, medical, and physical-chemical aspects of air pollution and its control. The subjects treated include the general field of air pollution; sources of air pollution; pathological and toxicological effects of air pollution; emission and diffusion of air pollutants; sampling, analysis, and measurement of air pollutants; air pollution surveys and statistical studies; atmospheric phenomena; legislation, administration, and enforcement; and urban planning and zoning. References concerning air pollution caused by agents of communicable disease, herbicides, insecticides, and radioactive materials are excluded. (auth)

Tracer Applications

2722 HW-52286
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TURNOVER AND TISSUE DISTRIBUTION OF RADIO-RUTHENIUM OXIDE IN THE LUNGS OF MICE. D. H. Willard, L. A. Temple, and W. J. Bair. Oct. 1, 1957. 18p. Contract W-31-109-eng-52. $0.75(OTS).

Whole-body turnover and tissue distribution of ruthenium in mice were studied for 427 days after single intratracheal injections of $Ru^{106}O_2$. Because of a continuously changing rate of turnover several values for the biological half life were calculated. Following the early period of high turnover rate the biological half life was 280 days when estimated by resolution of the turnover curve into a series of three exponentials. The retention of Ru^{106} was best represented by a power function and the average biological half life obtained by integration of the power function curve over a period of 230 days was 170 days. Integration of the exponential curve over the same period gave an average half life of 110 days. After 164 days a portion of the animals were sacrificed to determine the tissue distribution of Ru^{106}. The total-body burden was 12% of the initial dose with 92% of the body burden in the lungs. Other tissues showing high concentrations of Ru^{106} were the lymph nodes, spleen, kidney, and ovaries. (auth)

2723
SOME RESULTS OF RADIO-IODINE DIAGNOSTIC TESTS FOR THYROID FUNCTION. D. Brinkley, J. L. Haybittle, and K. J. Plested (Addenbrooke's Hospital, Cambridge, Eng.). Acta Radiol. 48, 33-51(1957) July.

Measurements of maximum percentage uptake of radio-iodine into the thyroid gland, the 48 hour plasma activity, and the 48 hour protein-bound I^{131} have been made in 99 patients. The value and shortcomings of the test as shown by comparison with the clinical findings in certain types of cases are discussed. (auth)

2724
HEALING BONE FRACTURES AND SIMULTANEOUS ADMINISTRATION OF RADIOISOTOPES OF SULFUR, CALCIUM AND YTTRIUM. N. S. MacDonald, P. C. Lorick, and L. I. Petriello (Univ. of California, Los Angeles). Am. J. Physiol. 191, 185-8(1957) Oct.

A mixture of carrier-free radioisotopes, Ca^{45}, Sn^{35} and Y^{91}, was injected into rats bearing left tibial fractures, in states of repair varying from 3 to 18 days. Twenty-four hours after injection, both tibias were removed and analyzed for content of each radioisotope. At all intervals up to 18 days, postfracture, the injured bone contained more of all three isotopes than the intact, contralateral mate. A maximum in 24 hours retention of radiosulfate in tissue at the fracture site, was reached by the 7th to 10th day, after which retentions of a dose of S^{35} declined rapidly. Retentions of a dose of Ca^{45} in the fractured bone also rose rapidly during the first 3 to 10 days of healing. Thereafter, 24 hour retention values continued to rise but at a reduced pace. The avidity of healing bone for yttrium increased sharply during the same 3 to 10 day interval during which radiosulfate deposition became most effective. After this time 24-hour retention values for Y_{91} increased only slightly, if at all. The data suggest that formation of the sulfated mucopolysaccharides of osteoid matrix and fibrocartilaginous callus began by at least the 3rd day, if not earlier. The healing fracture made its greatest demands for plasma sulfate during the 7th to 10th day, postfracture. New calcium was laid down at the fracture site just as early as new sulfate, but the demands for plasma Ca continued throughout the 18 days of observation, as might be expected for a mineralizing callus. Yttrium fixation in the healing bone appeared to be more closely related to events leading to organic matrix formation than to mineralization of the new tissue. (auth)

2725
RADIOISOTOPES IN BIOLOGY. J. A. Henry, A. Herve, and H. Maisin. J. belge radiol. 40, 564-77(1957). (In French)

The radio-isotopes are used in biology either as internal and external radiation sources or as tracers. A study is presented of the possible uses of tracer radioelements in experimental research on the whole body, on certain organs and tissues in vivo and in vitro, on cellular elements and finally on certain molecules of biological interest. (auth)

2726
RADIO-CAESIUM IN DRIED MILK. D. V. Booker (A.E.R.E., Harwell). Phys. in Med. and Biol. 2, 29-35 (1957) July.

A gamma scintillation spectrometer method for measuring the radio-cesium and potassium content of dried milk is described. The changes with time of the Cs^{137} activity in dried milk from Frome, Somerset are presented. Levels of Cs^{137} activity in full cream dried milk collected from October to December 1956 from five different areas were measured. (auth)

2727
THE SUBSTITUTION OF COMPLEXING SUBSTANCES FOR BORON IN PLANT GROWTH. John Skok (Argonne National

Lab., Lemont, Ill.). Plant Physiol. 32, 308-12(1957) July.

Several complex-forming elements including strontium, aluminum, and, particularly, germanium, were found to alleviate boron-deficiency symptoms temporarily and to increase growth of sunflower seedlings significantly in the absence of boron. These results provide evidence that the physiological role of boron is likely related in part to the complexing property of the borate ion. On the basis of translocation studies utilizing C^{14} sucrose and tests on the effect of sugar and citric acid applications to boron-deficient plants, it does not appear that boron is directly functional in sugar translocation because of the formation of a sugar-borate complex. (auth)

2728

UPTAKE OF CALCIUM-45 AND STRONTIUM-90 FROM WATER BY FRESH-WATER FISHES. Harold L. Rosenthal (Rochester General Hospital, N. Y.). Science 126, 699-700 (1957) Oct. 11.

2729

DIETARY CALCIUM LEVELS AND RETENTION OF RADIOSTRONTIUM IN THE GROWING RAT. R. H. Wasserman, C. L. Comar, and Daphne Papadopoulou (Oak Ridge Inst. of Nuclear Studies, Tenn.). Science 126, 1180-2(1957) Dec. 6.

CHEMISTRY

2730 AECD-4252

National Lead Co. of Ohio, Cincinnati.

A STUDY OF THE CARRIER DISTILLATION EXCITATION OF IRON IN U_3O_8. M. G. Atwell and C. E. Pepper. [1957?]. Decl. Oct. 1, 1957. 7p. Contract AT(30-1)-1156. $1.80(ph OTS); $1.80(mf OTS).

A radioactive tracer, Fe^{59}, was used to determine the disposition of iron as a result of the excitation of a U_3O_8 matrix in a d-c arc. Two different spectrographic procedures, both using carrier distillation excitation techniques, were compared as to the per cent of iron volatilized, the per cent of iron diffused into the electrode, and the per cent of iron remaining in the residual charge. (auth)

2731 AERE-C/R-1565

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MEASUREMENT OF INTERFACIAL IMPEDANCE. G. C. Barker. Nov. 1954. 9p.

A bridge circuit for the measurement of the a-c impedance of an electrode-solution interface is described which permits the use of a Luggin capillary or a probe electrode to minimize errors connected with the resistance of the solution near the interface. (auth)

2732 AFOSR-TN-57-602

Purdue Univ., Lafayette, Ind.

THE STOICHIOMETRY, RESISTIVITY, AND THERMOELECTRIC POWER OF CERIUM DIOXIDE BELOW 500°C. A. W. Czanderna and J. M. Honig. Sept. 1957. 33p. (AD-136-591).

2733 ANL-5750

Argonne National Lab., Lemont, Ill.

THE THERMOCHEMICAL PROPERTIES OF THE OXIDES, FLUORIDES, AND CHLORIDES TO 2500°K. Alvin Glassner. 1957. 70p. Contract W-31-109-eng-38. $0.45 (GPO).

This report supersedes ANL-5107.

Tables of thermochemical and thermodynamic properties of oxides, fluorides, and chlorides to 2,500°K are presented. (W.L.H.)

2734 BMI-785(Del.)

Battelle Memorial Inst., Columbus, Ohio.

THE PREPARATION OF BETA SILICON CARBIDE. J. R. Gambino, W. G. Mixer, Jr., H. E. Wagner, and C. G. Harman. Dec. 29, 1952. Decl. with deletions Feb. 19, 1957. 16p. Contract W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

Cubic silicon carbide was prepared which appeared to be particularly suitable for the fabrication of fuel elements having small cross sections. The particle size of the beta silicon carbide, as formed, was sufficiently fine and no grinding was necessary. Beta silicon carbide, the low-temperature, cubic modification, was formed from silica and carbon and from silicon and carbon mixtures under varying conditions. Heating time and temperature were varied, as well as type and proportion of starting material. High yields of beta silicon carbide could be formed at as low as 2640°F (1450°C) from silicon and carbon mixtures when excess carbon was present. The best yields were from mixtures of silica and carbon and were obtained from silica-rich mixtures at 3450°F (1900°C). Small amounts of alpha silicon carbide were formed at as low as 3270°F (1800°C) but the amount of alpha-type material remained small until 3630°F (2000°C) was reached. The yield of beta silicon carbide formed from silica and carbon at relatively high temperatures was higher than that from mixtures of silicon metal and carbon at lower temperatures. (auth)

2735 CCC-1024-TR-266

Callery Chemical Co., Penna.

BEHAVIOR OF DECABORANE IN ORGANIC SOLVENTS. Edward H. Uhler, Chilton H. McDonnell, Paul R. Wunz, Jr., and Robert G. Brault. Oct. 15, 1957. 13p. Project ZIP. Contract NOa(s)52-1024-c.

A brief investigation was made to find some nonreactive solvents for decaborane. Decaborane apparently does not react with ethyl ether, dioxane, ethyl acetate, ethyl carbonate, or p-cresol at room temperature; however it does react with ethyl ether and diborane at 100°C. Amides (formamide and N, N-dimethylformamide for example), acetone, n-butyraldehyde, and acetonitrile react with decaborane at room temperature. Additional studies should be made of the reaction between decaborane and nitromethane before positive statements can be made of the nature of this reaction. (auth)

2736 KAPL-1807

Knolls Atomic Power Lab., Schenectady, N. Y.

SOLUBILITY OF CARBON IN SODIUM AT ELEVATED TEMPERATURES. J. G. Gratton. June 30, 1957. 13p. Contract W-31-109-eng-52. $0.75(OTS).

An investigation was conducted to determine the solubility of carbon in sodium. This information was required to determine the difference in carburization of stainless steels between that caused by soluble carbon and that caused by suspended carbon. The data indicated that all carbon in amounts < 5μ was, in fact, sodium-soluble carbon. The solubility of carbon in sodium under the experimental conditions varied from 32 to 74 ppm in the temperature range 147° to 700°C. The variation in the solubility, (S = ppm) of carbon with temperature may be expressed ln S = $4.96 - 6.21 \times 10^3/T$ at 0.003% oxide content, and as ln S = $5.61 - 3.76 \times 10^3/T$ at 0.026% oxide content. (auth)

2737 KAPL-M-SAR-RES-9

Knolls Atomic Power Lab., Schenectady, N. Y.

QUALITATIVE OBSERVATIONS ON THE ZIRCONIUM–WATER REACTION AT ATMOSPHERIC PRESSURE. Douglas C. Layman. July 25, 1955. Decl. May 22, 1957. 40p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30 (mf OTS).

Self-sustaining and self-propagating chemical reactions between Zircaloy-2 and water have been obtained. High speed movies have been taken to illustrate the physical phenomenon involved. Qualitative results are reported for a test program limited to experiments at atmospheric pressure, stagnation, and 40 to 150°F subcooling, with power inputs of increasing exponentials in the range of 2 to 20 milliseconds. The chemical reaction was initiated at, or very close to, the melting point of Zircaloy, proceeded with varying rates, and sustained itself to complete loss of sample in some cases. The reaction showed the characteristics of a combustion process rather than an explosion. Based on the qualitative interpretation of the data, it is recommended that a further refined program of both analytical and experimental scope be immediately initiated. (auth)

2738 NP-6483

Rensselaer Polytechnic Inst., Troy, N. Y.

ELECTROCHEMISTRY OF MOLTEN ALKALI AND ALKALINE EARTH HALIDES CONTAINING HALIDES OF TITANIUM. Technical Report No. 4. Charles T. Brown, Henry J. Gardner, Cyril Solomons, and George J. Janz. Oct. 1957. 161p. RPI Project No. 441.10. Contract Nonr-591-(06).

2739 NP-6492

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

MEASUREMENT OF THERMAL PROPERTIES. Progress Report No. 4 [for] August and September, 1957. J. T. Lang and I. B. Fieldhouse. Oct. 14, 1957. 14p. ARF Project D106. Contract AF-33(616)-3701.

Data are given for the linear thermal expansion of synthetic sapphire, and stainless steels types 316 and 347 for the complete temperature range. Enthalpy measurements for stainless steel type 347 are also given. (W.L.H.)

2740 NYO-8022

Tufts Univ., Medford, Mass.

A SURVEY REPORT ON LITHIUM HYDRIDE: SUPPLEMENT, 1954–1957. Charles E. Messer and Thomas R. P. Gibb, Jr. Aug. 31, 1957. 20p. Contract AT(30-1)-1410. $0.75(OTS).

This report supplements NYO-3957.

2741 ORNL-1877(Rev.)

Oak Ridge National Lab., Tenn.

DISSOLUTION OF METALS IN FUSED FLUORIDES. R. E. Leuze, G. I. Cathers, and C. E. Schilling. Oct. 12, 1955. Decl. Mar. 6, 1957. 15p. Contract W-7405-eng-26. $0.30(OTS).

In scouting tests, a number of metals used in nuclear reactor fuel elements were dissolved by ZrF_4–KF–NaF fused salt at 675°C through which HF was being passed. These included type 304 stainless steel at 4 mils/hr; type 347Nb stainless steel at 7 mils/hr; Th at 14 mils/hr; nonirradiated U at 17 mils/hr; Zr at 22 to 35 mils/hr; Ti at 31 mils/hr; and Zircaloy-2 at 22 to 46 mils/hr. Only small amounts of volatile fission products formed when irradiated U was dissolved. Variables that appear to affect the dissolution rate are the composition of the fused fluoride, the fused fluoride temperature, the HF flow rate, the metallurgical characteristics of the material being dissolved, and the presence of other metals. The low dissolution rate of 0.001 mil/hr observed for nickel suggests that it may be suitable as a material of construction for reaction vessels. (auth)

2742 WADC-TR-57-45(Pt. I)

Reaction Motors, Inc., Denville, N. J.

HIGH TEMPERATURE STABLE SEMIORGANIC FLUIDS. Period Covered: March 1, 1956 to February 15, 1957. Daniel Grafstein, Rita Dudak, Murray S. Cohen, and Joseph Green. Feb. 15, 1957. 58p. Project Nos. 3044 and 7340. Contract AF-33(616)-3417. (AD-131099).

Phenyldichlorofluorosilane and methyldichlorofluorosilane, monomeric materials suitable for the preparation of polyorganofluorosiloxane polymers, were prepared in good yield and good conversion by the reaction of gaseous boron trifluoride with phenyldichloroethoxysilane and methyldichloroethoxysilane. Phenylmethylchlorofluorosilane and phenylmethylfluoroethoxysilane were synthesized and evaluated as chain stopping agents for the organofluorosiloxane polymers. The polymerization of these monomers were studied and the liquid polymers obtained were evaluated for potential use as high temperature base stock fluids. The relationship of physical properties to structural features of the polymeric oils was established. (auth)

2743 WIN-27

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

DEVELOPMENT OF AN EFFICIENT ELUANT FOR REMOVAL OF MOLYBDENUM FROM ANION EXCHANGE RESINS. Kenneth P. Quinlan and Robert J. Barry. Aug. 1, 1956. 21p. Contract AT(49-6)-924. $3.30(ph OTS); $2.40(mf OTS).

When acid leach liquors obtained from U ores containing Mo are contacted with anion exchange resin, both U and Mo are adsorbed. The adsorbed Mo is not removed in the normal U elution process, and when the U-barren resin is recycled, the resin sites already occupied by Mo are unavailable for U adsorption. In succeeding cycles, more and more sites become occupied by Mo, and the resin capacity for U is seriously lowered. This rapid accumulation of an adsorbed species is known as resin "poisoning." The many disadvantages of such a situation are self-evident. (auth)

2744 AD-129193

THE KINETICS AND MECHANISM OF NITRIC OXIDE DECOMPOSITION. A. I. Rozlovskii. Translated by Theodor Ranov from Zhur. Fiz. Khim. 30, 1349-55(1956). 14p.

2745 AEC-tr-3078

AN EXAMINATION OF AUTOCATALYTIC REACTIONS ON SURFACES OF SEPARATION. Georg-Maria Schwab and Siegfried Riethmayer. Translated from Z. Physik. Chem. (Frankfurt) 7, 342-59(1956). 15p.

2746 AEC-tr-3095

THE DETERMINATION OF SURFACE AREA OF POWDERS BY MEANS OF ADSORPTION IN THE LIQUID PHASE USING C^{14} STEARIC ACID. Eiji Mito, Masabumi Arakawa, and Akira Arakawa. Translated from J. Chem. Soc. Japan, Pure Chem. Sect. 75, 596-602(1954). 23p.

2747 AEC-tr-3097

POLARIZATION AND CRYSTAL GROWTH IN ELECTRODEPOSITION OF COPPER. R. Sroka and H. Fischer. Translated from Z. Elektrochem. 60, 109-18(1956). 34p.

2748

GENERAL CONSIDERATION OF THE MEASUREMENT AND CONTROL OF RADIOACTIVITY IN WATER. A. Pfau. Atompraxis 3, 389-98(1957) Oct. (In German)

2749

ISOTOPE EFFECT IN THE METHANOLYSIS OF GRIGNARD COMPOUNDS. Lars Olof Assarsson (Nobel Inst. of Chemistry, Stockholm, Sweden). Acta Chem. Scand. 11, 1283-4(1957).

2750

REACTIONS OF GASEOUS IONS. IV. WATER. F. W.

Lampe, F. H. Field, and J. L. Franklin (Humble Oil and Refining Co., Baytown, Texas). J. Am. Chem. Soc. 79, 6132-5(1957) Dec. 5.

The gas phase reactions of H_2O and D_2O with H_2O, D_2O, CH_4 and H_2 have been investigated and the specific reaction rates and cross sections measured. Relative cross sections of the reactions of D_2O with C_2H_6, C_3H_8, cyclo-C_3H_6, and n-C_4H_{10} have been measured. The ionic reactants in the ethane and propane systems are $C_2H_6^+$ and $C_3H_8^+$, respectively; water ion is the ionic reactant in all other systems (ionic reactant in the methane systems not known). The reaction cross sections are compared with those predicted from the polarizability theory of ion-molecule reactions, and it is concluded that the theory does not account satisfactorily for the values observed. The significance of the experimental results to the radiation chemistry of water is discussed. (auth)

2751

THERMAL ANALYSIS OF THE FERROUS CHLORIDE–POTASSIUM CHLORIDE SYSTEM. Harry L. Pinch and Jack M. Hirshon (Columbia Univ., New York). J. Am. Chem. Soc. 79, 6149-50(1957) Dec. 5.

The phase diagram for the system $FeCl_2$–KCl is presented. Two intermediate compounds exist: $KFeCl_3$ with a congruent melting point of 399° and K_2FeCl_4 with an incongruent melting point of 380°. There is a eutectic formed between K_2FeCl_4 and $KFeCl_3$ at 38.2 mole % $FeCl_2$ and another between $KFeCl_3$ and pure $FeCl_2$ at 54.2 mole % $FeCl_2$. There are also two solid–solid transitions. (auth)

2752

LATTICE CONSTANTS OF SEPARATED LITHIUM ISOTOPES. E. J. Covington and D. J. Montgomery (Michigan State Univ., East Lansing). J. Chem. Phys. 27, 1030-2 (1957) Nov.

The lattice constant for highly enriched (>99%) samples of Li^6 and Li^7 metal was determined at 20°C by x-ray-diffraction methods. The constant for Li^6 was found to be fractionally larger than that for Li^7 by about 4×10^{-4}. These results are not inconsistent with a rough theoretical estimate for the fractional difference of 3×10^{-4}. It is likely that the constant for Li^7 does not differ from that for natural lithium by more than 1×10^{-4} The fact that the lighter isotope has the larger lattice constant constitutes experimental evidence for the reality of zero-point energy. (auth)

2753

BULK DENSITY OF SEPARATED LITHIUM ISOTOPES. D. D. Snyder and D. J. Montgomery (Michigan State Univ., East Lansing). J. Chem. Phys. 27, 1033-4(1957) Nov.

The bulk density of extruded specimens of natural lithium and of enriched isotopes (>99%) was measured by the flotation-equilibrium and by the hydrostatic-balance methods. Upon correction for the slight chemical and isotopic impurities and upon reduction to 20°C, the following results were obtained for the bulk density in g/cm^3: Li^6, 0.460 ± 0.002; Li^7, 0.537 ± 0.003; lithium-natural, 0.531 ± 0.001. The crystal densities, calculated from the lattice constants determined by x-ray diffraction, are respectively 0.462, 0.539, 0.533, in each case about half a percent higher than the bulk density. (auth)

2754

ADSORPTION AND DIFFUSION OF HYDROGEN ON NICKEL. R. Wortman, R. Gomer, and R. Lundy (Univ. of Chicago, Ill.). J. Chem. Phys. 27, 1099-1107(1957) Nov.

The surface diffusion and adsorption of hydrogen on Ni field emitters has been investigated by a technique previously used for similar studies of H and O diffusion on W. It was found that diffusion occurs with an activation energy of 7 ± 1 kcal in the chemisorbed layer, without the precipitation boundaries observed on W. This is believed to result from the inherent homogeneity of f.c.c. substrates, on which most adsorption sites seem equivalent. This is supported by the marked lack of emission anisotropy of hydrogen-covered Ni field emitters. A field dependent transformation in the adsorbed film was found between 2° and 4°K and interpreted as a shift in the equilibrium between adsorbed H_2 molecules and the terminal fraction of adsorbed H atoms. The implications of this result for the mechanism of H_2-D_2 exchange are discussed. The activation energy of desorption at very low coverage is determined to be 46 ± 4 kcal from the temperature dependence of desorption rates. (auth)

2755

DISSOCIATION OF CO^+ AND CO^{++} IONS BY COLLISION WITH NEUTRAL MOLECULES. C. E. Melton and G. F. Wells (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 27, 1132-41(1957) Nov.

The dissociations of CO^+ and CO^{++} ions by ion-molecule collision have been investigated with a mass spectrometer. CO^+ dissociates into C^+ and O, or C and O^+, depending upon the energy of the parent ion. The predominant ion resulting from dissociation of CO^{++} is C^+ suggesting a charge-exchange dissociation reaction. This is supported by the observation that neutral molecules having high ionization potentials such as He and Ne do not produce dissociation in CO^{++}. Energy for the dissociation of CO^{++} is derived from the electronic energy of the molecular ion rather than from kinetic energy. (auth)

2756

THERMODYNAMICS OF THE Ti–Ti_2O_3 SYSTEM AND THE DISSOCIATION ENERGY OF TiO AND TiO_2. J. Berkowitz and Mark G. Inghram (Univ. of Chicago, Ill.) and W. A. Chupka (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 61, 1569-72(1957) Nov.

The concentration of gaseous species in equilibrium with various compositions of the solid Ti–TiO_2 system has been studied employing mass spectrometric analysis of the vapor effusing from a Knudsen cell. The gaseous species observed were Ti, TiO, and TiO_2. A thermodynamic treatment of ion intensities yields $TiO(s) \rightarrow TiO(g)$, $\Delta H^0_{298} = 139 \pm 5$ kcal./mole; $TiO_2(s) \rightarrow TiO_2(g)$, $\Delta H^0_{298} = 146 \pm 5$ kcal./mole. Combining these values for the heat of sublimation with other well known thermodynamic data yields 6.8 and 13.5 e.v., respectively, for the atomization energies of TiO and TiO_2. (auth)

2757

BERYLLIUM-HAZARD DETECTION USING POLONIUM-210 ALPHAS. R. Gold (Illinois Inst. of Tech., Chicago). Nucleonics 15, No. 11, 114, 116, 118(1957) Nov.

Samples of air-borne Be dust are collected on filter paper and exposed to a flux of Po^{210} α particles. The γ-ray yield of the $Be^9(\alpha,n\gamma)C^{12}$ reaction can then be used to analyze the Be content of the filter paper in 5 to 10 min. The predominant 4.43-Mev γ transition to the C^{12} ground state is detected with NaI(Tl) crystals. (L.T.W.)

Analytical Procedures

2758 AERE-C/M-323

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF SODIUM AND POTASSIUM IN A SAMPLE OF DUNITE BY RADIOACTIVATION ANALYSIS. L. Salmon. July 1957. 7p.

A sample of dunite has been analyzed for Na and K by

radioactivation, using recognized radiochemical separations. The value for Na was checked by activation followed by direct observation on a gamma spectrometer. The values obtained were K = 0.0032% and Na = 0.011%. (auth)

2759 AERE-C/R-1786

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SQUARE WAVE POLAROGRAPHY. PART IV. AN INTRODUCTION TO THE THEORETICAL ASPECTS OF SQUARE WAVE POLAROGRAPHY. G. C. Barker, R. L. Faircloth, and A. W. Gardner. Feb. 6, 1956. 43p. (See also AERE-C/R-1563.)

2760 AERE-C/R-2294

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF RADIOSTRONTIUM IN EFFLUENT. B. A. Loveridge and A. M. Thomas. June 1957. 12p.

Radiostrontium is determined in effluent by precipitation from an aliquot in the presence of Sr carrier. Interfering radionuclides are removed by a series of precipitations and scavenges before the radiochemically pure Sr is precipitated as the oxalate. The absolute activity is determined by comparison with a standard source prepared from a 4-π counted solution of $Sr^{90}-Y^{90}$. (auth)

2761 DP-236

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

POLAROGRAPHIC DETERMINATION OF URANIUM IN THE PRESENCE OF MOLYBDENUM. Robert C. Propst. Sept. 1957. 22p. Contract AT(07-2)-1. $0.75(OTS).

A polarographic method was developed for the determination of small concentrations of uranium in nitric acid solutions that contain high concentrations of aluminum. There is no interference from molybdenum(VI), mercury (II), or iron(III) and the precision of the analysis is 2.5 per cent. (auth)

2762 IDO-14418

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

DETERMINATION OF BORON IN ALUMINUM–URANIUM FUEL ELEMENTS. Kenneth W. Puphal, James A. Merrill, Glenn L. Booman, and James E. Rein. Oct. 16, 1957. 13p. Contract AT(10-1)-205. $0.50(OTS).

A rapid spectrophotometric method is described for the determination of boron in Al–U alloys, particularly in non-irradiated ETR fuel element samples. After dissolution of the sample in HCl and H_2O_2, the B is determined without separation by the carminic acid method. The complexes that U and Al form with carminic acid have weak absorbances at the working wavelength of 585 mμ. Compensation is easily made by including U and Al in the blank. The U content of the ETR alloy may vary as much as ±1.6 absolute % (±10 relative %), five times the specification limit, without affecting the results for B. Under routine conditions, the coefficient of variation is about 2.5% for ETR fuel containing 0.1 wt. % B. A Na_2CO_3 fusion pretreatment is described for B analysis in an alloy of Al and B_4C and in B-impregnated polyethylene tape. (auth)

2763 K-1042

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

DETERMINATION OF LITHIUM 6 BY FISSION COUNTING. C. A. Kienberger, R. E. Greene, and F. S. Voss. Aug. 25, 1953. Decl. Apr. 4, 1957. 12p. Contract W-7405-Eng-26. $1.80(ph OTS); $1.80(mf OTS).

A fission counting method for the determination of the weight percent of Li^6 in Li compounds is described. The method features the electroplating of thin films of Li metal from lithium chloride in acetone, conversion of the metal to the stable lithium fluoride with gaseous fluorine, exposure to thermal neutrons, and counting the α particles produced by fission. The assay is read from a curve of the counting rate vs. assay of a group of synthetic standards which are prepared by diluting enriched lithium with normal lithium to the desired isotopic values. The method is rapid and readily adaptable to routine analyses. The 95% confidence interval of a single determination is estimated to be ±1% of the value. (auth)

2764 K-1318

Oak Ridge Gaseous Diffusion Plant, Tenn.

MEASUREMENT OF COMPOSITION OF FREON 12–FREON 22 MIXTURES WITH A THERMAL CONDUCTIVITY GAS ANALYZER. H. S. McKown. May 29, 1957. 12p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A series of experiments was conducted to determine the conditions and operating techniques required to use thermal conductivity cells for the analysis of mixtures of Freon 22 and Freon 12. A response time of less than three minutes and a precision of ±0.01 percent in concentration was attained. (auth)

2765 KAPL-M-JR-10

Knolls Atomic Power Lab., Schenectady, N. Y.

SEMI-MICRO DETERMINATION OF URANIUM IN URANIUM DIOXIDE–ALUMINA CERAMICS. V. F. Consalvo and J. Rynasiewicz. Nov. 22, 1957. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Between 8 and 20 mg of U in $UO_2-Al_2O_3$ ceramic fuel sections were analyzed by a modified Jones Reductor–dichromate method with an absolute error of ±0.1 mg U. The samples were fused with sodium pyrosulfate, dissolved in 25 ml of 6% H_2SO_4, and passed through a miniature Zn-amalgam reductor. The resulting U^{3+} plus U^{4+} was converted entirely to U^{4+} by aeration and then titrated with 0.027N $K_2Cr_2O_7$ using diphenylamine sulfonate as the indicator. The contribution of Fe to the U result was eliminated by an independent Fe analysis (and correction) or by removing the Fe with a Hg cathode electrolysis. (auth)

2766 NBL-139

New Brunswick Lab., AEC, N. J.

SEMIANNUAL PROGRESS REPORT FOR THE PERIOD JANUARY 1957 THROUGH JUNE 1957. C. J. Rodden. Oct. 1957. 22p. $0.75(OTS).

Chloride ion is determined in solutions of Mg in dilute H_2SO_4 by measuring the voltage between two silver-silver chloride electrodes, one of which is immersed in the unknown solution and the other in a known solution. A method of eliminating alpha contamination in ionization chambers is being developed. To date, the most effective device for alpha decontamination in these chambers is a conductive silver coating brushed onto the chamber walls. This has reduced the effect of contamination as much as 77.0%. Permeability apparatus of the Knudsen-Flow type was constructed and applied to the examination of UO_3. Preliminary results indicated reasonable concordance with reactivity ratios. (For preceding period see NBL-134.) (auth)

2767 USNRDL-TR-185

Naval Radiological Defense Lab., San Francisco.

QUANTITATIVE ION-EXCHANGE SEPARATIONS FOR SEQUENTIAL RADIOCHEMICAL ANALYSIS. L. Wish. Oct. 10, 1957. 27p. Project NS-081-001.

A method for a rapid separation and determination of

Np, Pu, U, Zr, Nb, and Mo isotopes in mixed fission products is evolved from Dowex-2 anion-exchange equilibrium data of these elements in HCl, HCl–HF, and HNO_3. The fission products sample in concentrated HCl is added directly to the resin column, and no tracers or carriers or prior separations are required. The activities are eluted sequentially and determined directly in a gamma ray scintillation well counter or in a multi-channel gamma ray spectrometer. The yields are shown to be quantitative and the purity is equivalent to that obtained from the standard radiochemical procedure for Mo, Np, and Pu. The Zr and Nb fractions may contain gamma-ray impurities which are easily resolved by gamma ray spectrometry. The U is contaminated with the $Te^{132}-I^{132}$ pair and usually requires further purification. (auth)

2768 WAPD-C-38

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

SPECTROGRAPHIC DETERMINATION OF URANIUM IN FUEL PLATES. N. E. Gordon, Jr., R. M. Jacobs, and M. C. Rickel. Aug. 28, 1951. Decl. Mar. 18, 1957. 18p. $3.30(ph OTS); $2.40(mf OTS).

A rapid procedure for determining 2.0 to 6.0% U in U–Zr fuel plates by sparking directly the machined surface of the plate and photographing and evaluating the resulting spectra by conventional spectrographic techniques is described. The standard deviation and accuracy of the method proved comparable with the colorimetric chemical method. (L.T.W.)

2769

THE DETERMINATION OF CERIUM IN BISMUTH-BASE ALLOYS. J. W. Edwards and G. W. C. Milner (Atomic Energy Research Establishment, Harwell, nr. Didcot, Berks). Analyst 82, 593-4(1957) Aug.

Methods are presented for the determination of Ce in Bi-base alloys. (W.L.H.)

2770

THE DETERMINATION OF OXYGEN IN TITANIUM AND TITANIUM ALLOYS, BASED ON THE PRINCIPLE OF CHLORINATION. W. T. Elwell and D. M. Peake (Imperial Chemical Industries, Ltd., Kynoch Works, Witton, Birmingham). Analyst 82, 734-42(1957) Nov.

A chemical procedure for the determination of oxygen in titanium and titanium-base alloys is described. The solid sample is admixed with graphite and chlorinated in an atmosphere of argon and the products of the reaction are subsequently isolated, excess of chlorine being removed by reaction with antimony. The liberated carbon monoxide has been shown to bear a stoicheiometric relationship to the amount of oxygen present in the sample, and in the final stages of the procedure the purified carbon monoxide is oxidized to carbon dioxide and weighed. The results were reproducible when the procedure was applied to the analysis of titanium–manganese alloys; this potential application is an outstanding advantage over the vacuum fusion procedure. With a single apparatus, about twelve determinations can be completed in a normal working week of 5 days. This is about the same rate as that at which oxygen can be determined by the macro vacuum fusion procedure, but, whereas a complete vacuum fusion unit costs about 2500 pounds and requires fairly constant attention, apparatus for the recommended procedure costs about 120 pounds and it is estimated that three units could be operated simultaneously. (auth)

2771

SPECTROPHOTOMETRIC ESTIMATION OF MOLYBDENUM WITH TIRON. B. Sarma (National Chemical Lab., Poona). J. Sci. Ind. Research (India) 16B, 478-80(1957) Oct.

2772

DETERMINATION OF URANIUM IN IRON. L. Kosta. "J. Stefan" Inst. Repts. (Ljubljana) 2, 7-8(1955) May.

A method has been devised for the determination of very small concentrations of uranium in iron and iron-base alloys based on the elimination of iron, chromium, and other constituents on the mercury cathode and subsequent extraction of uranium with ethylacetate. By this procedure over 95% uranium has been recovered at a concentration level of 10^{-4} to 10^{-3} %. (auth)

2773

CONTRIBUTION TO THE POTENTIOMETRIC DETERMINATION OF URANIUM. I. Perman. "J. Stefan" Inst. Repts. (Ljubljana) 2, 27-37(1955) May. (In German)

A potentiometric method is presented for the determination of up to 0.05% U in ores. The U^{6+} is reduced with liquid Zn amalgam in a stream of air and titrated with (0.01N) permanganate or $Ce(SO_4)_2$. The interfering elements are removed by electrolysis at the Hg cathode and extraction of their cupferrates into chloroform. (tr-auth)

2774

NEW AND IMPROVED ANALYSES FOR TRI-N-BUTYL PHOSPHATE. Robert J. Allen and Michael A. DeSesa (National Lead Co., Winchester, Mass.). Nucleonics 15, No. 10, 88, 90, 92-4, 96, 98(1957) Oct.

The acid-saturation, decomposition, and uranium-saturation methods for the indirect determination of TBP were evaluated. The decomposition method is based on a conversion of the TBP to phosphoric acid followed by spectrophotometric or volumetric determination of the phosphate. The acid-saturation method consists of contacting the organic solvent containing TBP with a nitric acid solution and determining the amount of acid extracted into the organic phase. The uranium-saturation method consists of contacting the organic phase with a uranyl nitrate solution, and the amount of uranium extracted is determined fluorometrically or spectrophotometrically. New and improved versions of the saturation method are reported. The various reported versions of the decomposition method were not satisfactory either because of the excessive time and care required to obtain a complete conversion of TBP to phosphate or because of incomplete and variable decomposition of TBP. (L.T.W.)

2775

HOW TO SAVE TIME WHEN COUNTING WEAK SAMPLES. Nucleonics 15, No. 11, 118, 120(1957) Nov.

A method to determine background and counter efficiency with one observation is described which combines the speed of the constant-background method and the accuracy of the interleaved-measurements method. (L.T.W.)

2776

ISOTOPE DILUTION ANALYSES. DETERMINATION OF ORGANIC COMPOUNDS BY CHLORINE-36-ISOTOPE DILUTION ANALYSES. Poul Sørensen. Copenhagen, Jul. Gjellerups Forlag, 1957. 99p. (In Danish)

Deuterium and Deuterium Compounds

2777 AERE-Inf/Bib-87(Suppl. 5)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

HEAVY WATER. Bibliography of British, Canadian and American Reports, etc. and Selected References to the Published Literature. R. Clarke. June 1957. 32p.

The opportunity has been taken in this Supplement to include a list of the more important published papers on the production, purification, properties, and analysis of heavy water and deuterium (taken from Nuclear Science Abstracts

1948 to May 1957). The report references include some early reports which have only recently become available. (auth)

2778
HEAVY WATER IN GERMANY. Atomics 8, 428-30(1957) Nov.

The three practicable methods of concentration of deuterium are considered: distillation, electrolysis of water, and chemical exchange reactions. The status of German research is summarized. (M.H.R.)

Fluorine and Fluorine Compounds

2779
ANTIMONY PENTAFLUORIDE; DENSITY, MELTING POINT, AND VAPOR PRESSURE. Charles J. Hoffman and William L. Jolly (Univ. of California, Livermore). J. Phys. Chem. 61, 1574-5(1957) Nov.

2780
NUCLEAR MAGNETIC RESONANCE STUDIES OF BORON TRIFLUORIDE COMPLEX FORMATION. P. Diehl and R. A. Ogg, Jr. (Univ. of Basle, Switzerland). Nature 180, 1114(1957) Nov. 23.

2781
NEW V-CENTER SPIN RESONANCE IN LiF. M. H. Cohen, W. Känzig, and T. O. Woodruff (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 108, 1096-7(1957) Nov. 15.

Graphite

2782 HW-50244
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
VARIATION OF GRAPHITE DIFFUSION LENGTH WITH TEMPERATURE. R. C. Lloyd and C. R. Richey. May 17, 1957. 11p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A series of measurements performed to determine the dependence of the diffusion length of graphite on the temperature in the range 22 to 600°C is reported. A 101-in. graphite cube was constructed on top of a 20-in. high graphite base. The heating of the graphite was accomplished by use of 24 calrod heating units having a combined capacity of 108 kev. The four one-half-gram Ra–Be sources, which were placed in the base, were water-cooled and temperature monitored for protection against breakage due to overheating. The temperature mapping of the pile was accomplished by nine thermocouples spaced vertically at the center of the pile and three spaced horizontally, front to back. The side-to-side temperature variations for several pile temperatures are tabulated. Neutron flux measurements were made with a water-cooled, BF_3 counter; Au and In foils were used to check these results at several temperatures. The measured and calculated values are summarized. (M.H.R.)

2783 WADC-TR-57-491(Pt. I)
Carborundum Co., Niagara Falls, N. Y.
SiC-GRAPHITE BODY FOR ELEVATED TEMPERATURE SERVICE. Period Covered: July 1956 to July 1957. Carl F. Cline. June 1957. 21p. Project 2998. Contract AF-33(616)-3538. (AD-142022).

A graphite body bonded by silicon carbide has been developed which has physical properties superior to graphite alone. Data are presented for transverse rupture strength, density, chemical analysis, and tensile strength. One composition has an average transverse rupture strength of 12,000 psi at 1500°C as compared to 5,400 psi for ATJ graphite. A dynamic high temperature test was developed which utilizes the high current arc as its heat source. Data are presented on the stability of the developed bodies as compared with ATJ graphite when the materials are subjected to a preliminary version of the high temperature arc test. (auth)

2784
"MAGNETIC ACTIVITY" OF FREE CHARGE BEARERS IN GRAPHITIZED CARBON. Andre Marchand. Compt. rend. 245, 1534-6(1957) Oct. 28. (In French)

Certain samples of coke and carbon black have very closely related magnetic susceptibilities between 78° and 293°K. The existence of several types of charge bearers, some active and some inactive from the magnetic point of view, is considered. The experimental results suggest an interesting relation between the degeneration temperature and the susceptibility at low temperatures. (tr-auth)

2785
GRAPHITE IN NUCLEAR POWER INDUSTRY. SUMMARY OF FIVE PAPERS PRESENTED AT GRAPHITE SYMPOSIUM ORGANIZED BY THE SOCIETY OF CHEMICAL INDUSTRY, SEPT. 24-26. Nuclear Eng. 2, 483-4(1957) Nov.

2786
BAND STRUCTURE OF GRAPHITE AND DE HAAS-VAN ALPHEN EFFECT. J. W. McClure (National Carbon Co., Cleveland, Ohio). Phys. Rev. 108, 612-18(1957) Nov. 1.

The de Haas-van Alphen effect in the magnetic susceptibility of graphite has been interpreted by applying the susceptibility formula for general bands of Lifschitz and Kosevich to the band model of Slonczewski. The majority electrons and holes are responsible for the two periods of oscillation of the susceptibility. The analysis yields information concerning the band structure: (1) the total band overlap is about 0.03 ev, (2) the energy difference between the two doubly degenerate bands at the corner of the Brillouin zone is about 0.025 ev, (3) γ_0 must be larger than about 1.2 ev, and (4) the relation $\gamma_1 = 0.04\gamma_0^2$ holes approximately (where both γ's are in ev and correspond to Wallace's notation). Calculated carrier densities are 2.4×10^{-5} per atom for electrons and 1.8×10^{-5} per atom for holes, in rough agreement with estimates made from galvanomagnetic data. Rough agreement with electron specific-heat data is also obtained. (auth)

Laboratories and Equipment

2787 AERE-C/M-316
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
APPARATUS FOR SEMI-MICRO POTENTIOMETRIC TITRATIONS. B. K. Robinson. Aug. 1957. 7p.

An apparatus is described which uses a mechanically driven micrometer syringe in conjunction with a micro pipette for the delivery of 0.005 ml aliquots with an error of ± 2%. The mechanism is particularly suited to conducting potentiometric titrations for the determination of metal-ligand stability constants. (auth)

2788 AERE-C/R-2188
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
APPARATUS FOR THE PREPARATION, ANALYSIS AND INVESTIGATION OF PLUTONIUM SOLUTIONS. D. E. Glanville, D. W. Grant, and G. L. Strachan. Feb. 28, 1957. 26p.

The apparatus and glove box arrangement used in the work on the thermal stability of Pu solutions is described in detail and an assessment is made of its success in use. Some new techniques are described, including a clean method of carrying out evaporations in a Mk. 1A glove box, an arrangement for using a burette in such a box, and a method for making semi-quantitative spectrophotometric measurements at temperatures above 100°C. (auth)

2789

REMOTE HANDLING. 5. HANDLING TECHNIQUES. R. A. G. Welsher (A.E.R.E., Harwell). Nuclear Eng. 2, 469-73(1957) Nov.

Remote handling techniques and equipment are presented for handling beta-gamma and alpha-beta-gamma emitters. (W.L.H.)

2790

THROW-AWAY FILTER UNIT FOR RADIOACTIVE LIQUIDS. C. M. Nicholls and C. D. Boadle (Atomic Energy Research Establishment, Harwell, Berkshire, Eng.). Nucleonics 15, No. 11, 142-9(1957) Nov.

Several filtration methods for radioactive liquids are reviewed, and a filter unit designed at A.E.R.E. offering completely remote handling of an expendable filter is described in detail. (L.T.W.)

Radiation Chemistry

2791 NYO-4601

Temple Univ., Philadelphia. School of Medicine. Radiobiology Lab.

INVESTIGATION OF THE BREAKDOWN PRODUCTS OF PARA-AMINOBENZOIC ACID AFTER RADIATION WITH X-RAYS. Robert Robbins and Samuel Melvin. Jan. 31, 1954. 95p. Contract AT(30-1)-1196. $15.30(ph OTS); $5.40(mf OTS).

An investigation was made of the kinetics of the radio-induced breakdown of para-amino-benzoic acid (PABA), the chemical nature of the breakdown products, and the effects of PABA on the radiosensitivity of mice. PABA was found to have no effect on the mortality of x-irradiated mice. Chemical tests and study of the spectrum indicate that irradiation in aqueous solution converts PABA to 3-hydroxy-4- aminobenzoic acid. Ionic yield was observed to be constant above 5×10^{-5}M and to fall off below this concentration. In connection with this study, attempts were made to develop superior chemical dosimeters. Results are included from a survey of a number of systems. m-Nitrophenoxyacetic acid was found to be a useful dosimeter. It was found to have high stability and to produce color in direct proportion to the radiation dose without recourse to chemical development. (C.H.)

2792

ADDITION OF n-BUTYL MERCAPTAN TO 1-PENTENE ON IRRADIATION WITH X-RAYS OR GAMMA RAYS. I. 140 KVP. X-RAYS. II. EFFECT OF RIGOROUS DRYING AND DEGASSING. III. ENERGY DEPENDENCE, 140 KVP. TO 24.5 MEVP. A. Fontijn and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon). Can. J. Chem. 35, 1384-1413(1957) Dec.

n-Butyl mercaptan reacts with 1-pentene when irradiated with x and γ radiation. The dependence of reaction rate upon concentration of mercaptan and pentene was studied as well as the dependence on dose rate. A comparison with the photoinitiated reaction is made. Experiments on mixtures which had been rigorously degassed and dried suggest that the reaction kinetics are strongly dependent on traces of O_2 in the system. A possible mechanism for the reaction is given. The effect of energy variation on the addition of n-butyl mercaptan to 1-pentene was studied using radiations at 140 kvp, 1.25 Mev, and 24.5 Mevp. No appreciable energy dependence was found over this range. (auth)

2793

THE ACTION OF Co^{60} GAMMA RAYS AND OF FENTON'S REAGENT ON AQUEOUS BROMAL HYDRATE SOLUTIONS. R. J. Woods and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon). Can. J. Chem. 35, 1475-86(1957) Dec.

Aqueous bromal hydrate solutions have been irradiated with Co^{60} gamma rays and the production of acid measured. The effect of bromal hydrate concentration, dose rate, pH, and temperature upon the yield of acid has been determined. Major products of the radiolysis have been identified and are compared with those formed when aqueous bromal hydrate solutions are treated with Fenton's reagent, a mixture of hydrogen peroxide and ferrous sulfate solutions. It has been shown that Fenton's reagent will initiate a chain reaction in aqueous bromal hydrate solutions which produces hydrobromic acid. (auth)

2794

WATER DECOMPOSITION YIELDS IN THE RADIOLYSIS OF AQUEOUS FORMIC ACID–OXYGEN SOLUTIONS BY CYCLOTRON-PRODUCED RADIATIONS. Warren M. Garrison, Boyd M. Weeks, Joseph O. Ward, and Winifred Bennett (Univ. of California, Berkeley). J. Chem. Phys. 27, 1214-15(1957) Nov.

Water decomposition yields in the radiolysis of aqueous formic acid–oxygen solutions by cyclotron-produced protons and neutrons are reported. Two primary processes occur, (1) $H_2O = H + OH$ and (2) $H_2O = \frac{1}{2}H_2 + \frac{1}{2}H_2O_2$. The absolute yields of reactions 1 and 2 are essentially independent of pH over the corresponding range and, to a first approximation, are related to the yields of observed products by the equations $G(1) = G(CO_2) = -G(O_2)$, $G(2) = 2G(H_2)$, and $G(1) + 0.5\,G(2) = G(H_2O_2)$. The values $G(1) = 2.39 \pm 0.05$ and $G(2) = 1.26 \pm 0.18$ were obtained for 10-Mev protons. The value $G(1)/G(2) = 2.73 \pm 0.10$ was obtained from the neutron data. (L.T.W.)

2795

RADIATION CHEMISTRY OF SOLID PARAFFINS. A. I. Snow and H. C. Moyer (Sinclair Research Labs., Inc., Harvey, Ill.). J. Chem. Phys. 27, 1222-3(1957) Nov.

A wax consisting mainly (95%) of saturated straight chain molecules in the C_{20} to C_{31} range, with C_{28} and C_{27} predominating, was irradiated in a nitrogen atmosphere at various gamma doses up to 970 Mr. The polymer yield-dose curve is given. Degrees of unsaturation in the total sample and in the separated polymerized and unpolymerized fractions were determined. (L.T.W.)

2796

RADIATION POLYMERIZATION MAKES STRONGER POLYSTYRENE. E. L. Colichman and R. F. Fish (Atomics International, Canoga Park, Calif.). Nucleonics 15, No. 10, 134-7(1957) Oct.

2797

ION-MOLECULE REACTIONS. D. P. Stevenson (Shell Development Co., Emeryville, Calif.). J. Phys. Chem. 61, 1453-6(1957) Nov.

This paper is concerned with the implications of the recently noted very large specific rates of reactions between gaseous ions and molecules for the formulation of the mechanisms of reactions induced by such ionizing radiation as β or γ rays. It is concluded that such ion–molecule reactions play an important role in not only the formation of free radicals but also in the formation of certain products. (auth)

2798

MECHANISMS OF PROTECTION IN RADIOLYSIS OF ORGANIC SYSTEMS. Milton Burton and S. Lipsky (Univ.

of Notre Dame, Ind.). J. Phys. Chem. 61, 1461-5(1957) Nov.

The addition of relatively small amounts of certain substances to organic systems markedly reduces yields of radiolysis products. Several mechanisms can be invoked to explain this "protective" effect. These can be broadly classified into two types: first, a scavenger effect of the additives on free radicals produced from primarily excited and ionized solvent molecules; second, more pertinent to our present interest, an effect of additive on the precursors of the first chemical decomposition. The additive is assumed to provide an alternative path of energy dissipation, e.g., by inducing internal conversion in the excited solvent, by excitation transfer or by negative-ion formation. Benzene may act as a scavenger, but it appears also to exercise a strong protective effect via some form of this second mechanism. In general, part of the effect of typical radical scavengers may also involve the second mechanism. Chemical and physical evidences for various protection processes are reviewed. (auth)

2799

RADIATION CHEMISTRY OF ORGANIC COMPOUNDS. I. n-ALKANE LIQUIDS. H. A. Dewhurst (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem. 61, 1466-71(1957) Nov.

A series of n-alkane liquids, pentane to hexadecane, have been irradiated with 800 kvp electrons. The hydrogen yield, $G(H_2) \cong 4.9$, was found to be independent of the length of the carbon atom chain, whereas the methane yield decreased with increase in the length of the carbon atom chain. Infrared analysis has shown that the unsaturation produced is largely trans vinylene with a smaller amount of vinyl. Cas–liquid partition chromatography has shown that three primary product groups are formed: a dimer group, an intermediate group between the dimer and parent, and degradation group. These results show that C–C bond scission is an important process, contrary to conclusions based only on gas analysis. (auth)

2800

THE EFFECT OF SOLUTES ON THE RADIOLYSIS OF CYCLOHEXANE. Robert H. Schuler (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 61, 1472-6(1957) Nov.

Low concentrations of solutes which have high electron affinities, such as iodine, the alkyl halides and sulfur dioxide have been shown to decrease the hydrogen yield in the γ irradiation of cyclohexane by about 40%. This decrease in hydrogen yield is believed due to a transfer of energy to the solute probably by an electron capture mechanism. For these solutes at concentrations of the order of 10^{-2} mole fraction a number of other observations have been made of direct chemical interaction between the solute and solvent induced by the radiation. Solutions of hydrogen iodide give higher yields of hydrogen than pure cyclohexane. Changes in the radiation chemistry of these systems due to energy transfer effects which are important at higher concentrations appear to be absent at concentrations below 10^{-4} mole fraction. (auth)

2801

THE RADIOLYSIS AND MASS SPECTROMETRY OF SEVERAL DEUTERATED ETHANOLS. John G. Burr (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 61, 1477-80 (1957) Nov.

Five isotopic species of liquid ethanol have been irradiated with Co γ rays—CH_3CH_2OH, CD_3CH_2OH, CH_3CD_2OH, CH_3CH_2OD, and CD_3CD_2OD. From the rates of hydrogen production ($G(H_2)$), observed in these radiolyses, (1) $CH_3CH_2OH \rightarrow CH_3CHOH + H$, it is concluded that hydrogen production proceeds via a primary radical process wherein the hydrogen atoms originate almost exclusively from the CH_2- group (process 1). From measurements of the deuterium content of the radiolytic hydrogen, it is concluded that the ensuing abstraction reaction occurs principally on the –OH hydrogen (80 to 90%) by process 2 with a small amount occurring at the CH_3- group (10 to 20%) by process 3. (2) $H + CH_3CH_2OH \rightarrow CH_3CH_2O + H_2$; (3) $H + CH_3CH_2OH \rightarrow CH_2CH_2OH + H_2$. Examination of the mass spectra of these deuterated ethanols demonstrates that the formation of hydrogen atoms from electron impact on very tenuous ethanol gas proceeds by a similar mechanism. (auth)

2802

THE RADIOLYSIS OF DEUTERATED AND TRITIATED ACETIC ACIDS. John G. Burr (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 61, 1481-3(1957) Nov.

The deuterium content of the methane formed by radiolysis of deuterated acetic acids, and the tritium content of methane formed from tritiated acetic acids, both indicate that methane is formed from acetic acid almost exclusively by a radical process in which the intermediate methyl radicals abstract hydrogen almost entirely from the methyl group of acetic acid. The isotope content of the hydrogen produced in these irradiations, together with the rates of hydrogen production ($G(H_2)$) values suggest, although less conclusively than for methane, a radical process as the origin for hydrogen. The origin of methane by a radical process in the irradiation of liquid acetic acid is compared with the evidence for a similar radical process in the fragmentation of CH_3COOH by electron impact in the highly dilute gas (mass spectrum). (auth)

2803

A CORRELATION BETWEEN MASS SPECTRA AND RADIOLYSIS DATA. John G. Burr (Atomics International, Canoga Park, Calif.). J. Phys. Chem. 61, 1483-4(1957) Nov.

Four examples are given of an apparent similarity between the mechanisms of certain types of processes which can be observed in the data from mass spectra and in the data from liquid phase radiolysis of isotopically labeled organic molecules. The possible significance of this correlation is discussed. (auth)

2804

A SURVEY OF THE RADIATION CHEMISTRY OF SOME ALIPHATIC ETHERS. Amos S. Newton (Univ. of California, Berkeley). J. Phys. Chem. 61, 1485-9(1957) Nov.

The products resulting from the irradiation of seven liquid aliphatic ethers with helium ions have been determined. Correlation between the ethers and comparison with previous alcohol radiolysis data show the alkyl–oxygen bond to be most susceptible to rupture. The total G-value for reduction equivalent of 7 to 10 is in the same range as previous results with alcohols. A postulated rearrangement of the ethers to an alkene and an alcohol is shown to follow the number of hydrogens on carbon atoms beta to the oxygen. Possible mechanisms for the formation of certain other products are discussed. (auth)

2805

SOME ASPECTS OF THE RADIOLYSIS OF ISOPROPYL ETHER. Amos S. Newton (Univ. of California, Berkeley). J. Phys. Chem. 61, 1490-6(1957) Nov.

Data are presented on the effects of variations in total energy input (total dose), temperature, type of radiation, added iodine, and added acetaldehyde on the radiolysis products of isopropyl ether. The changes in product yield with changes in these variables have been qualitatively interpreted in terms of a mechanism involving both radical reactions and molecular disproportionations. (auth)

2806

STUDIES IN THE RADIOLYSIS OF FERROUS SULFATE SOLUTIONS. I. EFFECT OF OXYGEN CONCENTRATION

IN 0.8 N SULFURIC ACID. A. O. Allen and Walter G. Rothschild (Brookhaven National Lab., Upton, N. Y.). Radiation Research 7, 591-602(1957) Dec.

2807
STUDIES IN THE RADIOLYSIS OF FERROUS SULFATE SOLUTIONS. II. EFFECT OF ACID CONCENTRATION IN SOLUTIONS CONTAINING OXYGEN. A. O. Allen, Virginia D. Hogan, and Walter G. Rothschild (Brookhaven National Lab., Upton, N. Y.). Radiation Research 7, 603-8(1957) Dec.

2808
THERMAL PROTECTION OF CHOLINE CHLORIDE FROM DECOMPOSITION BY IONIZING RADIATION. I. Serlin (Brookhaven National Lab., Upton, N. Y.). Science 126, 261(1957) Aug. 9.

2809
ON THE MECHANISM OF INITIATION OF BOILING OF LIQUID METASTABLE SYSTEMS BY IONIZING RADIATION. G. A. Askar'ian (Academy of Sciences, USSR). Soviet Phys. JETP 4, 761-3(1957) June.

Radiation Effects

2810 AERE-C/M-290
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE GASES EVOLVED DURING THE DECOMPOSITION OF ANTHRACENE BY FISSION FRAGMENTS. D. F. Sangster. Sept. 1957. 9p.

A mixture of anthracene and UO_2 has been irradiated in the Harwell pile BEPO. The gases evolved were collected, measured and analyzed. G values found for the mixture were:- hydrogen 0.38, acetylene 0.09, ethylene 0.04, methane 0.01. These values decreased as the irradiation continued and possible reasons for this are given. (auth)

2811 HW-51346
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE EFFECTS OF IRRADIATION ON THE FLEXURAL SERVICE LIFE OF ZIEGLER POLYETHYLENE. J. H. Kleinpeter. July 11, 1957. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The exposure of Super Dylan polyethylene to a gamma field caused a marked lowering of the flex life in the region of 10^7 roentgen. At 10^8 roentgen, the flex life was greater than unirradiated material, and 10^9 roentgen increased the flex life 50-fold. The effect of gamma exposure upon softening point or no-strength temperature is minor. Data on the effect of beta exposure are insufficient to allow conclusions. (auth)

2812 NP-6494
Esso Research and Engineering Co., Linden, N. J.
NUCLEAR RADIATION RESISTANT TURBINE ENGINE LUBRICANTS. Quarterly Progress Report No. 6 for May 1 to August 1, 1957. Alfred H. Matuszak. 26p. Project title: RADIATION EFFECTS (MATERIALS). Task title: NUCLEAR RADIATION RESISTANT MATERIALS. Contract AF-33(616)-3181. (RL-11M-57).

Development of radiation resistant turbine engine lubricants for aircraft nuclear power plants is presented. The screening and evaluation of finished lubricants, modifications thereof, and base stocks are discussed. The screening of these lubricant materials is being done at 10^8 roentgens at the MTR and at Hanford. The evaluations are based on lubricant performance in tests described in current military specifications for turbine and high-temperature lubricants. Two finished lubricants and fourteen base stock blends are evaluated. The finished lubricants (upper cylinder oils) were found to be undesirable because of high panel-coking tendencies. An inhibited paraffinic base stock still continues to be the most promising candidate for a radiation resistant lubricant. It is reasonably stable at 10^8 r but is deficient in good foaming qualities. At 5×10^8 r, somewhat greater degradation is noted. It is being considered for irradiation at 10^9 r. Of the base stocks irradiated, Cabflex HS-10, an alkyl-aryl phthalate, looks very promising and is in the same area of stability as the di-tridecyl terephthalate discussed as a promising lubricant base stock in the previous quarterly report. It is less stable than the paraffinic base stock and will be irradiated at higher gamma dosages. In the report, the paraffinic base stock and the Cabflex HS-10 are discussed along with similar materials screened during the present contract period. Comparisons with materials previously tested are also included. (auth)

Rare Earths and Rare-earth Compounds

2813 AERE-C/R-2380
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE HYDROLYSIS OF THORIUM TETRAFLUORIDE BY HIGH TEMPERATURE WATER. J. K. Dawson, R. W. M. D'Eye, and D. R. Chilton. Dec. 1955. Reprinted Sept. 1957. 7p.

Declassified version of HARD-P/16.

Autoclave experiments have shown that ThF_4 is insufficiently stable in high temperature water for use in slurry form as blanket material for the homogeneous aqueous reactor. Appreciable hydrolysis takes place above 200°C with the formation of ThO_2 and $ThOF_2$, the inhydrolyzed fluoride also forming a complex analyzing as ThF_4, 0.5 H_2O. (auth)

2814 ORNL-1030(Del.)
Oak Ridge National Lab., Tenn.
AN INVESTIGATION OF ThF_4–FUSED SALT SOLUTIONS FOR HOMOGENEOUS BREEDER REACTORS. J. O. Blomeke. July 19, 1951. Decl. with deletions Feb. 20, 1957. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

A consideration of the characteristics of fused salt–ThF_4 solutions suitable for use in homogeneous reactors is presented, together with a brief survey of the literature pertaining to such solutions and a summary of the experimental work accomplished. (auth)

Separation Procedures

2815 AERE-C/R-413(Del.)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CHEMISTRY OF RUTHENIUM WITH REFERENCE TO THE PLUTONIUM SEPARATION PROCESS. PART IV. THE SULPHIDE TREATMENT FOR RUTHENIUM IN THE URANIUM STREAM. G. L. Miles and F. S. Martin. Nov. 1950. 17p.

The effects of the different variables in the Cu co-precipitation method for removing Ru from plant solutions are presented in graphical form and are discussed. Liter scale experiments with the copper sulfide method and also with graphite, charcoal, and antimony sulfide columns are described. The mechanism of the Ru removal process is discussed. It is concluded that although the graphite column process described is more efficient than a series of butex cycles in decontaminating U solutions from Ru, the

engineering problems that would be involved weigh heavily in favor of the latter process. (auth)

2816 AERE-C/R-933

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

COUNTER-CURRENT LIQUID-LIQUID EXTRACTION IN ANNULUS COLUMNS WITH SHEARING MOTION. R. Spence and R. J. W. Streeton. Sept. 22, 1952. 45p.

The rotary extractor has been investigated both from the point of view of mechanism of operation and from the point of view of utility for the extraction of uranium. It has been shown that there is a hyperbolic relationship between h/d and d/R_i (where R_i is the radius of the rotor, d is the width of the annulus, and h is the height of a single vertex). The height of equivalent theoretical stage (H.E.T.S.) varies as the cube root of the cross sectional area (hd) of the vertices and combination of these two relationships gives an expression for the H.E.T.S. in terms of R_i and d, viz: $H = \text{const.}\ (d^4 + R^2d^2/3)^{1/6}$. The expression holds over the whole of the range of sizes studied ($R_i = 0.075-6.66$ cm; $d = 0.05-1.6$ cm). The rate of transfer of uranyl nitrate across the interface between drops and continuous phase in the butex-aqueous system has been found to depend on the transport of the solvated uranyl nitrate molecule through a solvent film at the interface. The rate of transfer in the case of a single drop in the rotary column is only about twice that which is found for a drop falling freely through a static continuous phase. (auth)

2817 AERE-C/R-2319

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NITRATO NITROSYLRUTHENIUM COMPLEXES AND THEIR EXTRACTION FROM NITRIC ACID SYSTEMS BY TRIBUTYL PHOSPHATE. PART II. MINIATURE EXTRACTOR RUNS. G. J. Ashworth, P. G. M. Brown, J. M. Fletcher, and A. G. Wain. July 1957. 26p.

The fate of Ru, in runs in which these complexes were present in $UO_2(NO_3)_2-HNO_3$ feed solutions to a counter-current TBP extraction system, has been determined. The behavior of this form of Ru is correlated with the properties of the complexes given. Factors which are important or largely irrelevant to Ru decontamination are assessed for these complexes. (auth)

2818 DP-53

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

EQUILIBRIUM DISTRIBUTION DATA FOR PUREX AND SIMILAR EXTRACTION PROCESSES. Thomas H. Siddall, III, Sidney G. Parker, and William E. Prout. July 1957. 27p. Contract AT(07-2)-1. $0.75(OTS).

Data are presented for the equilibrium distribution of U, Th, and HNO_3 between solutions of tri-n-butyl phosphate in kerosene and the various aqueous solutions encountered in the separation of Pu and U and in processes for the recovery of U^{235} from spent reactor fuel. (auth)

2819 EAH-135

General Electric Co. General Engineering and Consulting Lab., Schenectady, N. Y.

DEVELOPMENT REPORT FOR ELECTROLYTIC CELL. C. G. Williams and G. R. Peterson. May 15, 1950. Decl. Feb. 18, 1957. 22p. (R-50GL19). $4.80(ph OTS); $2.70 (mf OTS).

The objective of this project was to remove impurities in the form of PbO_2 from a HNO_3 solution by electrolysis. This electrolytic cell must process up to a 15-gal. batch in a minimum of time. It is desirable that the impurity remaining after processing be less than 20 ppm. Construction and operation of the cell are described. (G.Y.)

2820 FIAT-SEN-R-3

Fiat. Sezione Energia Nucleare, Turin.

LA DEMINERALIZZAZIONE DELL'ACQUA MEDIANTE RESINE SCAMBIATRICI DI IONI. (The Demineralization of Water by Means of Ion Exchange Resin.) L. Pizzi and A. Rosatelli. May 1957. 13p.

The principles of ion exchange, the properties of exchange resins, and the possibility of their industrial applications are described. The problem of the demineralization of water and the plant for realizing such a process are described in detail. (tr-auth)

2821 HW-45972

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A SUMMARY OF THE HISTORY OF HANFORD REDOX PLANT SOLVENT. G. R. Kiel. Oct. 4, 1956. Decl. Mar. 19, 1957. 9p. Contract W-31-109-Eng-52. $0.50(OTS).

2822 IDO-14414

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

STARTUP OPERATION OF PRODUCTION FACILITY FOR SEPARATING BARIUM-140 FROM MTR FUEL. B. M. Legler, S. F. Fairbourne, P. N. Kelly, and R. A. Robinson. Sept. 1, 1957. 217p. Contract AT(10-1)-205. $5.50(OTS).

Described is the startup operation of a batch production facility for separating and purifying Ba^{140} from short-cooled MTR fuel. Extensive operation involving unirradiated material and low activity level material was conducted prior to high activity level operation. The heart of processing equipment is a special suspended type, batch, solid basket centrifuge which is used for liquid-solid separation. The process is based on the solubility characteristics of Ba and Ba salts in selected basic and acidic media. Startup operation demonstrated adequacy of the flowsheet under irradiation in plant equipment. Recovery of 25,000-c batches of Ba^{140} was shown to be possible with adequate reproducibility at an approximate cost of $3.00 per c. Operating time per batch is 30 hours. The problem of I removal from process off-gas remains unsolved because inadequate provision was made for I removal in the original facility. (auth)

2823 IDO-14420

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CHEMICAL PROCESSING INSTRUMENTATION AND CONTROL RESEARCH PROGRAM. Harry Schneider. Sept. 16, 1957. 27p. Contract AT(10-1)-205. $1.00(OTS).

A program for the development of analytical instrumentation and improved control techniques using these instruments as applied to nuclear fuel reprocessing is currently being undertaken by the Chemical Development Section of the CPP Technical Branch. The program philosophy and objectives, a survey of the problems involved, general approach, lines of endeavor and specific applications are presented. (auth)

2824 KAPL-1015

Knolls Atomic Power Lab., Schenectady, N. Y.

EVALUATION OF KAPL SEPARATIONS PROCESS STACK EFFLUENT. J. J. Fitzgerald. Jan. 5, 1954. Decl. Aug. 22, 1957. 29p. Contract W-31-109-eng-52. $0.25(OTS).

The KAPL separations process stack effluent is evaluated. The adequacy and the efficiency of all the sampling instruments are determined. The size of the particles entrained in the stack is studied under both the light and the electron microscope. The mean particle size is less than 0.05 μ. Autoradiographs of the particulate material indicate that the majority of the activity is deposited on these submicronic particles. Chemical separations of the

material deposited on the Hollingsworth and Vose, H-70 filter papers and the caustic scrubber are made. The rare earths comprise the largest portion of the particulate activity while Ru^{106} is given off in relatively large quantities during the head-end operation. The relative percentages of the activities given off during the most important phases of the separations process are tabulated. The KAPL stack effluent is then evaluated on the basis of the maximum permissible concentrations recommended in the Bureau of Standards Handbook 52. (auth)

2825 KAPL-1788

Knolls Atomic Power Lab., Schenectady, N. Y.

REPROCESSING URANIUM BY THE DEBOER VOLATILE IODIDE PROCESS. W. L. Robb. May 1, 1957. 25p. Contract W-31-109-Eng-52. $0.75(OTS).

Experiments were conducted to demonstrate the use of the deBoer volatile iodide process as a method for decontaminating U metal or U alloy fuel elements. Decontamination from all long-lived radioactive fission products except Zr was obtained by forming UI_4, volatilizing the iodide, and then decomposing it to deposit U metal on a hot wire. By selective condensation of the UI_4, separation of U and Zr was produced. The ability to codeposit U and Zr as might be desired in reprocessing U–Zr fuel elements, was demonstrated. The deposition of molten U metal on a heated ZrC cylinder and the continuous removal of the U from the cylinder were also investigated. A design of a processing plant is described, and the problems inherent to its construction and operation are discussed. (auth)

2826 LA-2013

Los Alamos Scientific Lab., N. Mex.

COPRECIPITATION OF Am(III) WITH LANTHANUM OXALATE. John A. Hermann. Mar. 1956. 98p. Contract W-7405-eng-36. $2.75(OTS).

This report supersedes AECD-3637 (LAMS-1625).

The coprecipitation of americium with $La_2(C_2O_4)_3 \cdot 11H_2O$ is investigated. The separation and purification of americium from lanthanum and other cationic impurities by fractional precipitation of lanthanum oxalate is demonstrated. Fractions of the lanthanum oxalate carrier were precipitated from homogeneous solutions by the hydrolysis of dimethyl oxalate in dilute nitric acid solutions. Americium is enriched in the precipitate in accordance with the heterogeneous distribution law of Doerner and Hoskins up to a composition of at least 14 mole % americium in the precipitate. Americium was separated from all other cationic impurities detected to a degree equal to or greater than the separation from lanthanum. The impurities detected included bismuth, iron, chromium, aluminum, lead, manganese, magnesium, calcium, strontium and barium. The extent of coprecipitation of americium is shown to vary with the rate of precipitation of lanthanum oxalate, decreasing as the rate of precipitation increases. A theory for the effect of rate of precipitation on coprecipitation is presented, based on the qualitative relationship between rate of precipitation and supersaturation. An equation relating the observed distribution coefficient with the supersaturation, and thus indirectly with the rate of precipitation, is derived. The application of the supersaturation concept to published data on coprecipitation and to occlusion of impurities by analytical precipitates is discussed. It is suggested that many carrying phenomena of ionic precipitates which have been explained qualitatively by occlusion can be explained quantitatively by relating coprecipitation to supersaturation. A new method of measuring the heterogeneous distribution coefficient is presented. The method depends upon achieving experimental conditions such that the carrier precipitate is brought down from a saturated solution of constant carrier concentration. Under these conditions the heterogeneous distribution coefficient, λ, is determined experimentally in accordance with the equation

$$\log_e \frac{\text{total tracer}}{\text{tracer left in solution}} = \lambda \frac{\text{weight of carrier precipitated}}{\text{weight of carrier in solution}}.$$

For the americium-lanthanum oxalate coprecipitation system the distribution coefficient was found to be 6.5 ± 0.1. The method has possible industrial application in the field of radioactive-waste decontamination. A high "carrying" efficiency requires not that the distribution coefficient be high but that the ratio of the distribution coefficient to the carrier solubility be high. (auth)

2827 NAA-SR-2030

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRE QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1957. D. I. Sinizer, J. R. Foltz, K. L. Mattern, and E. E. Motta. Sept. 15, 1957. 50p. Contract AT-11-1-GEN-8. $1.25(OTS).

Design changes in the Pyroprocessing-Refabrication Experiment facility, hot cell structure, and mockup area are summarized. Developments in fuel rod fabrication, fuel can wire-wrapping, and fuel rod inspection are discussed. Drawings of the oxide-drossing furnace, the vacuum-casting furnace, the degassing furnace, the slug inspection device, and the material transfer lock are included. Discussions of the design and development of the maintenance cell, hot cell supporting services, and hot cell auxiliary processes are given. Drawings and photographs of the gas-handling systems are also included. (For preceding period see NAA-SR-2030.) (M.H.R.)

2828 RCTC/P-87

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SIMPLE MELTING AND CASTING FOR THE PROCESSING OF FAST REACTOR FUEL ELEMENTS. B. A. J. Lister and R. A. Davies. Feb. 14, 1957. 10p.

A critical examination is made of methods of processing fast reactor fuel elements by simple melting and casting. An outline scheme is considered for a possible process. A suggestion is made for continuous processing in the presence of molten calcium. (auth)

2829 WAPD-SFR-PD-113

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

MIXED RED ION EXCHANGE RESIN RATIO TESTS 10 PARTS CATION TO 1 PART ANION. Final Report. G. P Simon and W. J. Singley. [June 7, 1956]. 8p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

Because of the higher proportion of cations to anions (other than hydroxyl) found in the primary coolant of pressurized water systems the possibility of reducing the amount of anion resin in mixed bed resin demineralizers was considered. A significant reduction in the volume of anion resin would permit the use of smaller demineralizers or, alternatively, might increase the life of a resin charge for the same sized demineralizer. In order to determine the feasibility of reducing the anion resin volume, a series of tests were run in which a mixed bed resin consisting of 10 parts by volume of cation resin to 1 part of anion resin (instead of the 1 part by volume of cation resin to 2 parts of anion resin currently used) was used as the demineralizer in out-of-pile, pressurized water loops. Results from the tests indicated that performance of the 10/1 ratio mixed bed resins did not meet conductivity

specifications for existing pressurized water reactor systems. Furthermore, the 10/1 ratio resin exhibited poor breakthrough performance as indicated by acid leakage from the bed. In addition, resin breakthrough appeared to occur with only a small fraction of the residual capacity of the resin exhausted. It was concluded, therefore, that a 10/1 resin ratio was not adequate for use in pressurized water reactor systems, and the program has been concluded. It is possible that some other resin ratio less than 10/1 would be satisfactory for the proposed application. (auth)

2830 WIN-81

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

PILOT PLANT TESTING OF DAKOTA LIGNITES. G. R. Pitmon, M. A. Peters, H. E. Gardner, Guy Winslow, and R. L. Shimmin. Oct. 18, 1957. 147p. Contract AT(49-6)-924. $22.80(ph OTS); $7.20(mf OTS).

The pilot plant investigation of recovering uranium from Dakota lignites is discussed. Details on FluoSolids roasting, acid leaching, washing and solvent extraction are presented. (auth)

2831

SEPARATION OF STRONTIUM-90 AND YTTRIUM-90 AND THE PREPARATION OF CARRIER-FREE YTTRIUM-90. David Dyrssen (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 11, 1277-8(1957).

2832

OPERATION OF A CENTER-FED CONTINUOUS-FLOW THERMOGRAVITATIONAL COLUMN WITH UNEQUAL FLOW RATES IN THE TWO COLUMN SECTIONS. COMPARISON OF THEORY AND EXPERIMENT. John E. Powers and C. R. Wilke (Univ. of California, Berkeley). J. Chem. Phys. 27, 1000-1(1957) Nov.

Equations of Jones and Furry are shown to agree well with experimental data over a range of ratios of rectifying section flow to stripping section flow from 0.3 to 5. On the assumption of an effective feed location which yields maximum separation a tentative modification of the Jones-Furry equation is developed which appears preferable at smaller values of the flow rate. (auth)

2833

THE SOLVENT EXTRACTION BEHAVIOR OF INORGANIC COMPOUNDS. IV. VARIATION OF THE DISTRIBUTION QUOTIENT WITH CHLORIDE, HYDROGEN ION HELD CONSTANT. R. M. Diamond (Cornell Univ., Ithaca, N. Y.). J. Phys. Chem. 61, 1522-31(1957) Nov.

The variation in the distribution quotient for tracer indium(III) distributing between the oxygenated solvents, diethyl, butyl ethyl, dibutyl and β,β'-dichlorodiethyl ether, methyl isobutyl and diisobutyl ketone, dibutyl phthalate, methyl benzoate, methyl salicylate, 2-ethylhexanol and decanol, and aqueous solutions of hydrochloric acid, in which the concentration of HCl was varied while keeping the total ionic strength constant with $HClO_4$ or HNO_3, was studied. The results are compared with the behavior expected from expressions derived for D and d log D/d log [HCl]. It is shown that certain aspects of the variation in D are indeed indicated by the derived expressions, particularly a "common ion" effect when the ion $InCl_4^-$ is the principal organic phase indium-containing species and an increase in D when ion associations containing $InCl_4^-$ are possible in the organic phase. The remaining major effect is interpreted on the basis of a previous suggestion that the availability, or non-availability, of water in the aqueous phase for solvating ionic species is an important factor in the extraction process. These considerations are not restricted to the indium(III) chloride system, but appear to hold generally for those metal halides which extract into oxygenated organic solvents as the anions of strong acids. (auth)

2834

SEPARATION OF ZIRCONIUM AND HAFNIUM USING ANION-EXCHANGE RESINS. PART II. INFLUENCE OF PHYSICAL FACTORS. K. S. Rajan and J. Gupta (National Chemical Lab., Poona). J. Sci. Ind. Research (India) 16B, 459-63(1957) Oct.

The influence of some factors on the differential elution of hafnium and zirconium on Amberlite IRA 400 anion-exchange resin was investigated to ascertain the optimum conditions for the separation of hafnium from zirconium. The data obtained from experiments on 200 mg mixed oxide were successfully applied to 5 g mixed oxide loads on Amberlite IRA 400 and Dowex 2 columns for preparing spectroscopically pure hafnium and zirconium oxides. (auth)

2835

EFFECT OF PETROLEUM ETHER ON THE SEPARATION OF URANIUM IN LOW GRADE SAMPLES WHEN USING CELLULOSE COLUMNS. D. Lebez and M. Ostanek. "J. Stefan" Inst. Repts. (Ljubljana) 2, 9-13(1955) May.

The chromatographic method using cellulose columns for the separation of uranium has been improved by the addition of petroleum ether to the ether–nitric acid solvent. The mixed solvent has been successfully used in the analysis of siliceous ores containing 10^{-4} % U. The advantage of the proposed solvent mixture is the increased capacity of the cellulose to hold aqueous phase. (auth)

2836

FUEL REPROCESSING SERIES. I. FUEL REPROCESSING BY AQUEOUS METHODS. Edward L. Anderson, Jr. (U. S. Atomic Energy Commission, Washington). Nucleonics 15, No. 10, 72-7(1957) Oct.

This is the first of a definitive and comprehensive series that will cover aqueous processing, volatility and pyrometallurgical methods, high-level waste disposal, and processing economics. Information is included on processing chemistry (Redox and Purex Processes, enriched fuels, and Th processing), processing engineering (batch dissolution and solvent-extraction contactors), "head-end" concept (STR and SIR head-end processes, universal approach, mechanical handling, and Zircex and Darex head-ends), and ultimate processes. (L.T.W.)

2837

PLUTONIUM RECYCLING WITH MOLTEN UF_4. Archie G. Buyers (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 15, No. 11, 100-3(1957) Nov.

Plutonium transfer from spent to fresh uranium fuel by oxidation into molten UF_4 and reduction of the fluoride mixture to U–Pu alloy was successfully accomplished. Scaled up, the process is calculated to yield 85% of the Pu. Final alloy should contain 15 to 35% of the rare earths and 10% of other fission products. Suggested applications are to the Sodium Graphite Reactor and enriched-core fast-breeder fuel cycles. (auth)

2838

FUEL REPROCESSING SERIES. II. LOW-DECONTAMINATION AND VOLATILITY METHODS. Edward L. Anderson, Jr. (U. S. Atomic Energy Commission, Washington). Nucleonics 15, No. 12, 44-9(1957) Dec.

Volatility processes, like solvent extraction processes, are able to achieve high decontamination. The basis of these processes lies in the differences in volatility of the uranium, plutonium, and fission product fluorides. Low-temperature processes, high-temperature processes, and hazards are discussed. Low-decontamination processes have as their objective the purification of reactor fuels only

to a level such that they are suitable for reactor recycling. High decontamination refers to DF's of the order of 10^6 to 10^8 whereas low decontamination refers to DF's of the order of 10 to 100 (perhaps for only certain fission products). Two approaches to low decontamination systems are discussed, aqueous and pyrometallurgical systems. (L.T.W.)

Sorption Phenomena

2839
A METHOD OF SURFACE ANALYSIS AND ITS APPLICATION TO REDUCED NICKEL POWDER. M. W. Roberts and K. W. Sykes (Univ. Coll., Swansea). Proc. Roy. Soc. (London) A242, 534-43(1957) Nov. 19.

The possibility of analyzing the complex surfaces of reduced metals by comparing their adsorptive properties with the known behavior of evaporated films has been explored by experiments on nickel powder. Nickel prepared by reduction of the oxide in hydrogen at 450°C for periods up to 12 hr has been shown by measurement of hydrogen and krypton adsorption at −183°C to have a surface containing up to 37% of clean nickel atoms. Traces of silica introduced during the preparation of the powder possibly account for the rest of the surface. Adsorption of hydrogen at −183°C is effectively complete within ½ min at about 10^{-5} mm, and all gas is desorbed by evacuation at 450°C. Oxide is probably not a significant impurity, because the powder does not exhibit the slow adsorption at 20°C and above which is characteristic of incompletely reduced nickel. Such activated adsorption can be restored by the addition of oxygen and eliminated again by further reduction; its stoichiometry suggests that the process consists of hydroxyl formation. Reduction of the sulfide gives nickel of appreciable surface area but completely inert to hydrogen; presumably a stable layer of sulfide is retained. Some thermodynamic and kinetic problems involved in the preparation of metal powders with surfaces of known purity are briefly discussed in the light of these results. (auth)

Spectroscopy

2840
INFRARED SPECTRUM OF NT_4Cl. H. W. Morgan, P. A. Staats, and J. H. Goldstein (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 27, 1212(1957) Nov.

The infrared frequencies of ND_4^+, NT_4^+, NHT_3^+, were observed and measured with a Perkin-Elmer spectrometer, using NaCl and LiF prisms. (W.L.H.)

2841
INFRARED SPECTRA OF $N^{15}H_3$ AND $N^{15}H_4^+$. H. W. Morgan, P. A. Staats, and J. H. Goldstein (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 27, 1212-13(1957) Nov.

The infrared spectra of $N^{15}H_3$ and the $N^{15}H_4$ ion (in NH_4Cl) were observed with a double-beam spectrometer equipped with NaCl and LiF prisms. (W.L.H.)

Syntheses

2842 WADC-TR-57-391
Illinois. Univ., Urbana.
POLYMERIZATION THROUGH COORDINATION. Period covered: October 1, 1955 to September 30, 1956. John C. Bailar, Jr., William C. Drinkard, Jr., and Malcolm L. Judd. Aug. 1, 1957. 52p. Project title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF-33(616)-3209.

The preparation and properties of metal-containing polymers in which the metal ion is held in the polymer through coordinate bonds was studied. It is expected that such polymers will have exceptional stability toward heat and chemical reagents. The background for the formation of such polymers is presented and the principles involved in the preparation of plastic materials are discussed. Pertinent literature references are cited. Chelate polymers containing bis-β-diketones, bis-8-hydroxyquinolines, β-hydroxyethylpolyamines, and bis-α-amino acids have been investigated, as well as polymeric phthalocyanines. The most promising results have been obtained with the polymeric phthalocyanines, which have molecular weights up to about 30,000. (auth)

Transuranic Elements and Compounds

2843 AERE-M/M-171
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ESTIMATION OF THE COEFFICIENT OF THERMAL EXPANSION OF PuO_2 BETWEEN 0 AND 500°C. P. G. Mardon and M. B. Waldron. July 1957. 6p.

2844
PRELIMINARY TERM ANALYSIS OF Am I AND Am II SPECTRA. Mark Fred and Frank S. Tompkins (Argonne National Lab., Lemont, Ill.). J. Opt. Soc. Amer. 47, 1076-87(1957) Dec.

Wavelengths of over 3000 americium lines have been measured with a 30-ft spectrograph, and intensities compared in a number of sources leading to assignment of most lines as Am I or Am II. Hyperfine structure and isotope shifts have been measured in high orders for many lines. In this paper only the classified lines are listed, consisting of 173 Am II lines representing transitions between 5 odd levels and 63 even levels, and 112 Am I transitions between 12 odd levels and 39 even levels. Although the number of classified lines is less than 10% of the total almost all the strong lines are included. The ground states of Am II and Am I are $5f^7 7s$ and $5f^7 7s^2$, respectively. The ionization potential of Am I is 6.0 ev. Most of the levels have not been identified but are believed to be built on $5f^6 6d$ instead of $5f^7$. The binding energy of $5f^7$ compared with $5f^6 6d$ is 10,000 cm^{-1} smaller than in Eu and is related to the higher valences found in the 5*f* elements compared with the 4*f* elements. The ratio of the nuclear magnetic moments of Am^{241} and Am^{243} is $\mu_{241}/\mu_{243} = 1.008$. (auth)

2845
PREPARATION OF TRANS-URANIUM ELEMENTS. H. A. C. McKay (Atomic Energy Research Establishment, Harwell). Nature 180, 1010-12(1957) Nov. 16.

The history of the various methods of producing transuranic elements through No is reviewed briefly. The limitations and advantages of neutron irradiation of U, thermonuclear explosions reactions, and heavy-ion bombardment processes are discussed. (M.H.R.)

2846
THE PREPARATION OF NOBELIUM. J. Milsted (Atomic Energy Research Establishment, Harwell). Nature 180, 1012-13(1957) Nov. 16.

The problems involved and the people who worked in the preparation of No are mentioned briefly. The new bombardment technique and the chemical separation methods are discussed. (M.H.R.)

2847
PLUTONIUM AND ITS ALLOYS. K. Q. Bagley (Culcheth Labs., U.K.A.E.A.I.G.). Nuclear Eng. 2, 461-8(1957) Nov.

The occurrence, availability, extraction, nuclear properties, physical properties, compatibility, fabrication, and handling of Pu and its alloys are described. (W.L.H.)

Uranium and Uranium Compounds

2848 K-680

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

ELECTROCHEMICAL PREPARATION OF URANIUM TETRAFLUORIDE. PART I. LOW TEMPERATURE CELL. A. L. Allen, R. W. Anderson, R. M. McGill, and E. W. Powell. Nov. 10, 1950. Decl. Apr. 10, 1957. 75p. Contract W-7405-Eng-26. $12.30(ph OTS); $4.50(mf OTS).

A study was made of the low temperature electrochemical preparation of UF_4 from UO_3. At temperatures below 35°C the reduction of UO_2F_2 solutions (prepared by dissolving UO_3 in aqueous HF) in the presence of excess HF resulted in the precipitation of a UF_4 hydrate ($UF_4 \cdot 2.5\ H_2O$). This hydrate was subsequently filtered, washed, dried, and dehydrated. A product with a low concentration of metal impurities, a tap density of approximately 0.5 g/cc, and a surface area of approximately 2.9 sq. m/g was obtained. Average current efficiencies from 65.3 to 86.5% were obtained; and to produce a pound of UF_4 precipitate formed in the low temperature cells required: (1) batch cell operation, and (2) the continuous removal of the precipitate by batch filtration. Since the depleted electrolyte was recycled to aid in dissolving the UO_3 feed, no waste processing was necessary and only stoichiometric quantities of HF were required. (auth)

2849 K-722(Add. I)

Oak Ridge Gaseous Diffusion Plant, Tenn.

VAPOR PRESSURE TABLES FOR LIQUID URANIUM HEXAFLUORIDE. A. A. Brooks and P. Wood. Nov. 21, 1957. 7p. Contract W-7405-eng-26. $0.50(OTS).

Tabular values of the saturated vapor pressure of liquid uranium hexafluoride and the derivative of the vapor pressure with respect to temperature are presented. (auth)

2850 K-790(Del.)

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

EXCHANGE OF URANIUM BETWEEN BETA URANIUM PENTAFLUORIDE AND GASEOUS URANIUM HEXAFLUORIDE. W. Davis, Jr. and G. P. Rutledge. July 13, 1951. Decl. with deletions Feb. 27, 1957. 27p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Exchange of U between β UF_5 and gaseous UF_6 has been studied in the temperature range 80 to 140°C. Series experiments, consisting of exposure of a sample of enriched (17.98 wt. % U^{235}) UF_5 to several successive samples of normal UF_6, as well as one-exposure experiments have been performed. The decrease in first order rate constants, indicates that neither chemical reaction at the gas-solid interface nor diffusion of UF_6 through an adsorbed gas layer controls the rate of exchange of U between gas and solid. Exchange rates are compatible with a process controlled by diffusion of U in and through the solid. Estimates of the diffusion coefficient vary from 0.3 to 11×10^{-14} sq. cm/hr (on the basis of N_2 surface areas and the assumption of uniform particle size). The effect of temperature is poorly defined by the present data, being equivalent to an activation energy for diffusion of 7.3 ± 12.5 kcal/mole. Over the temperature range 80 to 140°C the average value of the diffusion coefficient is 2.6×10^{-14} sq. cm/hr. (auth)

2851 TID-10046

Battelle Memorial Inst., Columbus, Ohio.

EXAMINATION AND PROPERTIES OF URANIUM ALLOYS. H. A. Saller and F. A. Rough. Oct. 20, 1953. Decl. Mar. 16, 1957. 22p. Contract W-7405-eng-92. $0.25(OTS).

The heat treatment, microstructure, hardness, and density data for a series of uranium alloys are described. These are alloys which were studied because of their potential interest for high-temperature water-corrosion resistance. The alloys studied include uranium–zirconium binary alloys, uranium–zirconium-base ternary alloys, and uranium–molybdenum alloys. (auth)

2852 WAPD-184

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PROPERTIES OF UO_2. J. Belle and B. Lustman. Sept. 1957. 140p. Contract AT-11-1-GEN-14. $3.75(OTS).

Information on the out-of-pile properties of UO_2 is reviewed. Methods of preparation and characterization of UO_2 powders are discussed. Results of experimental studies on the sintering process for UO_2 are treated phenomenologically, and mechanisms for sintering are suggested. Results of some physical measurements made on UO_2 are given, including melting point, thermal conductivity, modulus of elasticity, modulus of rupture, and electrical and magnetic properties. The thermodynamic and kinetic aspects of the UO_2-O_2 and UO_2-H_2O systems are examined, and measurements and interpretations of self-diffusion of uranium and oxygen in UO_2 are discussed. (auth)

2853 Y-F33-3

Oak Ridge National Lab., [Y-12 Area], Tenn.

THE SOLID PHASES OF ALKALI AND URANIUM FLUORIDE SYSTEMS. A. G. H. Andersen. Oct. 1, 1952. Decl. Feb. 22, 1957. 24p. Contract W-7405-eng-26. $4.80 (ph OTS); $2.70(mf OTS).

Phase studies of UF_4-BeF_2-NaF and ZrF_4-NaF systems are presented. (W.L.H.)

2854 IGRL-T/CA-56

HEAT OF FORMATION OF URANYL FLUORIDE AND HEAT OF REACTION OF URANIUM HEXAFLUORIDE AND TETRAFLUORIDE WITH WATER. M. M. Popov, F. A. Kostylev, and T. F. Karpova. Translated by E. G. Peters from Zhur. Neorgan. Khim. 2, 9-12(1957). 7p.

When the present work was begun, in 1950, data concerning the thermal chemistry of fluoric compounds of uranium were far from complete. In particular, there were no data about the heat of formation of UO_2F_2, the heat of hydrolysis of UF_6, and the heat of hydration of UF_4: this limited the possibility of making thermodynamic calculations of reactions in which the above compounds take part. The present work was intended to provide these data. (auth)

2855

STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XXVIII. THE DISTRIBUTION OF SOME ACTINIDES AND FISSION PRODUCTS BETWEEN TRIBUTYL PHOSPHATE (TBP) AND AQUEOUS SOLUTIONS OF HNO_3 AND $Ca(NO_3)_2$. Brita Bernström and Jan Rydberg (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 11, 1173-82(1957).

The distribution ratios of U^{6+}, Pu^{6+}, Pu^{4+}, Th^{4+}, Ru, Zr^{4+} Nb^{5+}, La^{3+}, Sr^{2+}, and Ca^{2+} between tributyl phosphate (TBP) and aqueous solutions of varying concentrations of HNO_3 have been determined at room temperature for different (constant) concentrations of $Ca(NO_3)_2$ in the aqueous phase. The extraction curves are discussed with respect to the different complexes formed and to the possibility of using the investigated systems for separating Pu and U from the fission products. (auth)

2856

ON THE SYNTHESIS OF URANIUM HEXAFLUORIDE. B. Brčić and J. Slivnik. "J. Stefan" Inst. Repts. (Ljubljana) 2, 47-50(1955) May.

The preparation of anhydrous HF, F_2, UF_4, and UF_6 by partially modified methods described in the literature is presented. (W.L.H.)

2857

URANIUM IN SOUTH AFRICA. Peter Holz. Nuclear Eng. 2, 457-60(1957) Nov.

The production of U in South Africa from ores which have had the gold removed is described. (W.L.H.)

2858

MAGNETIC ANALYSIS OF THE URANIUM–OXYGEN SYSTEM. Anthony Arrott (Carnegie Inst. of Tech., Pittsburgh) and J. E. Goldman (Ford Motor Co., Dearborn, Mich.). Phys. Rev. 108, 948-53(1957) Nov. 15.

Magnetic susceptibility measurements have been carried out on the uranium–oxygen system in the composition range of UO_2 to $UO_{2.67}$. The existence of an antiferromagnetic transition at compositions close to stoichiometric UO_2 which had been previously reported by the authors has been confirmed. The data make it possible to define clearly the phase limits of the UO_2 and U_3O_8 structures and to determine unambiguously that the excess oxygen ions in the nonstoichiometric salts occupy interstitial positions in the lattice. (auth)

Waste Disposal

2859 WAPD-T-436

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

CONTROL OF RADIOACTIVE MATERIAL AT THE PRESSURIZED WATER REACTOR. Jacques R. LaPointe and Robert D. Brown. [1957]. 24p. PWR Project $4.80 (ph OTS); $2.70(mf OTS).

Prepared for presentation at the 1957 Nuclear Engineering and Science Congress, March 10-16, Philadelphia.

Criteria are presented for the ultimate disposal of radioactive wastes from the Pressurized Water Reactor. The design aspects involved in applying these principles to the radioactive disposal facilities are discussed. The types of wastes encountered and the processes developed at the plant are detailed. (auth)

ENGINEERING

2860 DP-231

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

SAMPLER FOR POWDERED MATERIAL. William R. Kennedy, Jr. Aug. 1957. 8p. Contract AT(07-2)-1. $0.50(OTS).

An automatic mechanism has been developed that obtains a representative sample of free-flowing powdered material dropping down a vertical pipe. This device embodies the principle of an oscillating slotted "shutter" which momentarily admits a small increment of process material to a collecting vessel. (auth)

2861 NEPA-1244

Michigan. Univ., Ann Arbor. Engineering Research Inst.

DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP TO TEMPERATURES OF 3500°F. Progress Report No. 17 [for] November 15 to December 16, 1949. M. J. Sinnott. Dec. 16, 1949. 6p. Project M781. For Fairchild Engine and Airplane Corp. NEPA Div. Contract [W-33-08-ac-14801(16250)].

A life of one-hundred hours has been obtained on a graphite induction heated furnace operating at 3350°F. Preliminary creep tests on 4811 ceramic specimens and on molybdenum coated with $MoSi_2$ to temperatures of 2100°F have been made. Experimental work on the calibration and operation of a circuit utilizing photo-electron-multiplier tubes for measuring high temperatures is being carried forward. (auth)

2862 NEPA-1313

Michigan. Univ., Ann Arbor. Engineering Research Inst.

DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP TO TEMPERATURES OF 3500°F. Progress Report No. 19 [for] January 15, [1950] to February 15, 1950. M. J. Sinnott. Feb. 20, 1950. 9p. Project M781. For Fairchild Engine and Airplane Corp. NEPA Div. Contract [W-33-08-ac-14801(16250)].

A relocation of the power lines to the laboratories necessitated the shutting down of all of the creep tests units for an appreciable part of this last work period. A detailed description of the graphite induction furnace for use in creep testing under oxidizing conditions to 3500°F is presented. Preliminary tests on single crystal rods of Al_2O_3 at 3300 and 3500°F indicate they have suitable stability for use as component parts of the extensometers. Sensitivity tests and some exploratory temperature measurements have been made with the photo-multiplier tube circuit. (auth)

2863

INDUSTRIAL NUCLEONIC GAGING. J. E. Reider (Industrial Nucleonics Corp., Columbus, Ohio). Non-Destructive Testing 15, 360-5(1957) Nov.-Dec.

In any production control system, several functions are always performed such as measuring, controlling, monitoring, recording, and classifying. Noncontact isotope gages have been developed to a high level of accuracy, reliability, and speed to meet these needs. Production control systems using this type of measuring unit are in operation throughout industry on many different applications for metalworking, paper making, rubber and plastics calendering and extruding, paper converting, food processing, cigarette making, and textile combining. In all cases greater precision in the control of the process is obtained through the use of noncontacting radiation measurement equipment and related automatic controls. (auth)

2864

HOW TO TAKE SAMPLES FROM LIQUID METAL LOOPS. Marx Weech and Gordon Fluke (Univ. of Michigan, Ann Arbor). Nucleonics 15, No. 10, 112(1957) Oct.

A sampler is described which gives leak-free performance and requires a minimum of operator attention. The sampler design will operate in either a high vacuum or an inert gas atmosphere of low or moderate pressure. (L.T.W.)

2865

THE SCIENCE OF ENGINEERING MATERIALS. J. E. Goldman, ed. New York, John Wiley & Sons, Inc., 1957. 542p.

A series of lectures on the impact of solid-state science on engineering materials, based on the proceedings of the Carnegie Conference held at Carnegie Institute of Technology in June 1954, is presented. (auth)

Heat Transfer and Fluid Flow

2866 APEX-327

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

DESIGN AND OPERATION OF A SODIUM-TO-LITHIUM-TO-AIR HEAT TRANSFER SYSTEM. Work Period from September 1949 to June 1953. A. R. Crocker, R. L. Potter, R. J. Spera, T. D. McLay, and S. H. Esleeck. Dec. 1954. 195p. $5.00(OTS).

This report describes the design and operation of a 50-gallon-per-minute liquid-metal circulating system transferring heat from sodium to lithium to air. Included is a detailed listing of the test equipment with its cost and installation expense. (auth)

2867 CF-57-11-65
Oak Ridge National Lab., Tenn.
AN EXTENSION OF THE ESSLINGER SHELL RELATIONSHIPS TO INCLUDE EFFECTS OF AXIAL LOAD AND TEMPERATURE. B. L. Greenstreet and D. M. Miller. Nov. 19, 1957. 18p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

2868 IDO-28005
Aerojet-General Corp., Azusa, Calif.
POLYPHENYL-COOLANT BURNOUT STUDIES. Monthly Progress Report No. 11 [for] September 16 through October 15, 1957. Nov. 18, 1957. 17p. Contract AT(04-3)-44. (L2917-11). $3.30(ph OTS); $2.40(mf OTS).

The objective of this program is to determine whether polyphenyl compounds, such as Santowax-R or other terphenyl compounds, are suitable for use as heat-transfer fluids in organic-moderated reactors. The maximum-allowable heat flux to the fluid will be established experimentally by determining the heat-flux rate at the beginning of film-boiling for various pressures, fluid velocities, and fluid temperatures. (auth)

2869 IDO-28006
Aerojet-General Corp., Azusa, Calif.
POLYPHENYL-COOLANT BURNOUT STUDIES. Monthly Progress Report No. 12 [for] October 16 through November 15, 1957. K. Sato. Dec. 13, 1957. 68p. Contract AT(04-3)-44. (L2917-12). $10.80(ph OTS); $3.90(mf OTS).

The objective of this program is to determine whether polyphenyl compounds such as Santowax-R, or other terphenyl compounds, are suitable for use as heat-transfer fluids in organic-moderated reactors. The maximum allowable heat flux to the fluid will be established experimentally be determining the heat-flux rate at the beginning of film-boiling for various pressures, fluid velocities, and fluid temperatures. (auth)

2870 KAPL-M-RE-418A
Knolls Atomic Power Lab., Schenectady, N. Y.
TEST DATA REPORT ON 36-RIBBON COLD WATER PRESSURE DROP-TEST NO. 418A. G. R. Pflasterer. June 4, 1956. 18p. SAR Project. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Data on pressure drop across a bundle of 36 ribbons of oval and flat shapes are given. The effect of pitch was studied. (T.R.H.)

2871 KAPL-M-SAR-RES-2
[Knolls Atomic Power Lab.,] Schenectady, N. Y.
HEAT TRANSFER TEST PROGRAM EVALUATING FLOW STABILITY IN NUCLEATE SURFACE BOILING. Douglas C. Layman. May 6, 1955. Decl. Mar. 13, 1957. 7p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The need for data permitting an evaluation of coolant flow disturbances in the Submarine Advanced Reactor core due to nucleate surface boiling is discussed. (L.T.W.)

2872 KAPL-M-SMS-41
Knolls Atomic Power Lab., Schenectady, N. Y.
ATTENUATION OF THERMAL WAVES IN PIPING. A. J. Arker and M. DaCosta. Sept. 17, 1956. 35p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

A study was conducted to determine the effects of piping heat capacity on relatively rapid thermal transients in reactor coolant systems. It was concluded that piping heat capacity could be neglected or treated with any reasonable approximation for flow rates and pipe lengths similar to those of the SAR. This conclusion is applicable for flow rates of 50% or higher. For flow rates of 10% or lower, significant errors could be introduced by neglecting this factor. A detailed description of the computer program, used in this study is included. This program may find application for other work. For a given fluid inlet temperature and flow rate as a function of time, it will calculate transient temperature distribution in the fluid and pipe walls. (auth)

2873 WAPD-TH-106
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PRESSURE DROP THROUGH RECTANGULAR ORIFICES. B. W. LeTourneau and R. E. Grimble. Aug. 5, 1955. Decl. Apr. 10, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

An experimental determination was made of the pressure drop through rectangular orifices at the entrance to plate-type subassemblies. The experiments were performed in the Bettis low-pressure hydraulic loop. The orifices used were sheet brass picture frames clamped to the upstream end of the subassembly model. Results are presented in graphical form. (B.J.H.)

2874 WAPD-TH-238
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
TEST SPECIFICATIONS FOR THE PWR TESTS IN THE COLUMBIA UNIVERSITY TRANSIENT LOOP. R. Masnovi and J. D. Roarty. [Aug. 1956]. 19p. $3.30(ph OTS); $2.40(mf OTS).

2875
FINNED TUBES AND THEIR PERFORMANCE CHARACTERISTICS. A. Lymer (Simon-Carves, Ltd.). Nuclear Eng. 2, 504-9(1957) Dec.

The importance of rapid comparison of different types of extended-surface tubes can hardly be over-estimated. Theoretical and practical methods of this are described in this article which emphasizes that the final assessment of tube performance depends on the total cost (capital and running costs) of the complete steam unit. (auth)

Materials Testing

2876 CF-57-11-57
Oak Ridge National Lab., Tenn.
HIGH PRESSURE EJECTOR TEST. B. A. Hannaford. Nov. 12, 1957. 8p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

A commercial jet ejector was operated over a range of pressures up to 1500 psi to determine its characteristics. The purpose of the test was to establish head-capacity and efficiency curves to serve as a guide in sizing much larger jets for high pressure applications. Presumably, larger jets would have similar characteristics except for flow rate. Water, circulated by a canned-rotor pump, was the motive fluid; the driven fluid was N gas. All tests were run at room temperature. Both gas head and efficiency varied directly with system pressure up to 1000 psi and dropped slightly at 1500 psi. The optimum operating point was not reached, but efficiencies of approximately 25% were attained at 1000 to 1500 psi. The ejector appears attractive as a simple and efficient device for pumping gas at high pressure. (auth)

2877 CF-57-11-140
Oak Ridge National Lab., Tenn.
DESIGN AND DEVELOPMENT OF A 1/2-INCH TITANIUM

TO STAINLESS FLANGE. B. D. Draper and H. C. Roller. Nov. 27, 1957. 20p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

A ½-in. Ti to stainless ring joint flange with a leak detection facility has been designed, fabricated, and given preliminary thermal cycling tests. The flange consists of a Ti stub end and carbon steel lap joint flange; a 17-4 PH stainless steel octagonal ring; and a carbon steel, welding neck, ring joint flange clad with stainless steel. Preliminary thermal cycling tests indicate that the transition flange will function properly in the intended application; namely, the installation of a titanium letdown heat exchanger in the HRT mockup. (auth)

2878 KAPL-1826

Knolls Atomic Power Lab., Schenectady, N. Y.

GRISCOM-RUSSELL TWO-TUBE EVAPORATOR. C. F. Barrett, Jr. June 28, 1957. 11p. Contract W-31-109-eng-52. $0.75(OTS).

Results of the metallographic examination are presented of the Griscom-Russell two-tube evaporator after testing for a total steaming time of 3856 hr. The complete absence of any adverse effect on the material leads to the conclusion that 2¼% Cr–1% Mo alloy steel can be used advantageously in liquid metal heat exchangers when the oxygen content of the boiler water is controlled. (auth)

2879 KAPL-M-EDL-19

Knolls Atomic Power Lab., Schenectady, N. Y.

RUBBER BOOT GAS SEAL, PROPERTIES TESTS. D. F. Wood. June 1, 1953. Decl. Mar. 11, 1957. 68p. Contract W-31-109-Eng-52. $10.80(ph OTS); $3.90(mf OTS).

A series of tests was conducted for the purpose of evaluating the properties of the rubber boot seal proposed for the control drive shaft of the Submarine Intermediate Reactor Mark A. These tests were performed with prototype boots on a test facility that simulated the general control drive operations. As the test proceeded, the seal system components were changed as indicated by the preceding results, and re-evaluation tests were conducted. (auth)

2880 KAPL-M-EDL-32

Knolls Atomic Power Lab., Schenectady, N. Y.

LIFE TESTS: NICHROME PIPE HEATING CABLE. Charles D. Best. Apr. 15, 1953. 15p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Life tests of nichrome heating cable for liquid metal systems revealed that it will last virtually indefinitely, with reasonable care, below 1000°F. Temperature cycling reduces the life. Under normal conditions 5 amperes may be used for insulated cable and 8 amperes for bare cable. (T.R.H.)

2881 KAPL-M-EDL-74

Knolls Atomic Power Lab., Schenectady, N. Y.

THERMAL SHOCKING OF PLATED MATERIALS FOR MARK A CONTROL GUIDE BEARINGS. J. M. Marshall. June 10, 1954. 11p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Two specimens, one of 52100 steel and the other of 416 stainless steel, both flame-plated with tungsten carbide, were subjected to thermal shock cycles to evaluate the adherence of the carbide to the steel. (L.T.W.)

2882 KAPL-M-WEC-11

Knolls Atomic Power Lab., Schenectady, N. Y.

THE SIGNIFICANCE OF MATERIAL PROPERTIES TO DESIGN. W. E. Cooper. Oct. 17, 1957. 33p. Contract W-31-109-eng-52. $6.30(ph OTS); $3.00(mf OTS).

The significance of material properties to design is discussed. It is not intended that this be a complete treatment of the subject but rather that the pertinent sources of information be outlined and the major factors discussed in brief. Discussed in this section are the various tests commonly used in the determination of mechanical properties, their significance, and their application to design. This includes the tensile, the impact or brittle fracture type, creep and stress rupture, and fatigue tests as well as a general discussion of the significance of radiation effects. (auth)

2883 WADC-TR-57-135

Sintercast Corp. of America, Yonkers, N. Y.

A STUDY OF GRADED CERMET COMPONENTS FOR HIGH TEMPERATURE TURBINE APPLICATIONS. [Period covered] May 1, 1956 to February 28, 1957. Henry W. Lawendel and Claus G. Goetzel. May 24, 1957. 47p. Project No. 7350. Contract AF33(616)-3670. (AD-131031).

The purpose of this investigation is a preliminary study of graded cermet turbine components designed to improve the ductility and toughness of the root and airfoil tip sections. Ballistic impact tests at low and high temperature, before and after heat shock cycling, were performed on a wedge-like simulated turbine bucket shape divided into three general areas representing the root, airfoil tip, and airfoil body sections of a turbine bucket. For the cermet core of the bodies, a cermet was selected on the basis of preliminary tests which consisted of titanium carbide infiltrated with molten Inconel-X; for the metal-rich layers applied to the root and airfoil tip sections, an alloy was selected consisting of Inconel-X enriched with titanium carbide. The core material had a carbide concentration corresponding to 61 to 63% of theoretical carbide density as measured on skeleton bodies prior to infiltration. The stress to withstand 100 hours life at 1800°F of this core material was found to be in the order of 12,000 psi. The metal-rich alloy layers analyzed approximately 10% by weight of titanium carbide; the stress of this material to withstand a 100-hour life at 1600°F was found to be in the order of 20,000 psi. (auth)

2884 WAPD-CP-1150(Rev.)

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PROPOSAL FOR FUEL ROD PROOF-TEST IN WAPD-CR-5, CENTRAL THIMBLE LOOP, NRX REACTOR, AECL. A. P. Miller. May 31, 1955. Decl. Mar. 19, 1957. 10p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

A proposal is presented by the Atomic Power Division of the Westinghouse Electric Corporation (WAPD) to perform a proof test of two UO_2 fuel rod bundles in the WAPD-CR-5 loop installed in the Central Thimble position of the NRX Reactor of the Atomic Energy of Canada, Ltd. (AECL). WAPD is authorized by the Atomic Energy Commission (AEC) to conduct this test to study (1) the effect of heat flux on corrosion of cladding and welds, (2) the effect of heat flux on dimensional stability of fuel elements, (3) the effect of heat flux gradient on distortion of bundles (flux gradient will be simulated by varying the enrichment in the rods), (4) the comparison of two types of assembly methods. Performance of these tests jointly with AECL is authorized under the Technical Cooperation Program. (auth)

2885

ULTRASONIC TESTING OF MATERIAL FOR NUCLEAR COMPONENTS. Frank W. Armstrong (Babcock & Wilcox Co., Barberton, Ohio). Non-Destructive Testing 15, 342–4, 350(1957) Nov.-Dec.

Pumps

2886 AERE-CE/M-150

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRELIMINARY INVESTIGATION OF THE GAS LIFT

PUMP FOR CIRCULATING HEAVY LIQUID METALS. F. Roberts and P. F. Wace. Aug. 1955. 17p. (MSWP/N-12).

The gas lift pump has not been considered here as a prime mover for circulating coolant through a primary circuit, in view of the complexity which would arise in designing such a pump to overcome the head losses associated with the secondary large volumetric flow rates. The purpose of this investigation was merely to make a preliminary study of the general character of a heavy liquid metal gas-lift, to compare its operation with that of water, and to obtain some idea of the relationship of efficiency to flow rate. (A.C.)

2887 CF-57-11-122
Oak Ridge National Lab., Tenn.
SINTERED ALUMINA AS A PUMP BEARING AND JOURNAL MATERIAL. H. C. Savage. Nov. 26, 1957. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Design criteria and operating experience with the aluminum oxide bearing and journal combination as installed in canned rotor pumps in in-pile loops are described. No pump failures occurred in 8 pumps with Al_2O_3 bearings over a cumulative period of 10,000 hours due to wear or corrosion. Five failures due to slippage and/or electrical breakdown of the stator insulation are reported. (T.R.H.)

2888 KAPL-M-EDL-18
Knolls Atomic Power Lab., Schenectady, N. Y.
PRESSURE DROP STUDIES OF FOUR EM PUMP MODELS. R. H. Stokes. Oct. 29, 1952. Decl. Mar. 12, 1957. 26p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The hydraulic losses as affecting the operating over-all pump efficiency were determined. Pressure drop, or head loss, studies were made on four pump models: the standard and shortened 37 psi pumps, the elliptical design, and the 75 psi Mark A pump. All four models were tested under the same piping conditions, and the results are tabulated. Considering head loss and length, by an arbitrary definition giving a performance factor, the 37 psi long inlet transition and the 75 psi outlet transition pieces are the most efficient. (auth)

2889 KAPL-M-EDL-29
Knolls Atomic Power Lab., Schenectady, N. Y.
CAVITATION STUDIES ON THREE EM PUMP MODELS. R. H. Stokes. Jan. 7, 1953. Decl. Mar. 12, 1957. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Cavitation studies were made with water on $\frac{3}{8}$ scale models of the 37 psi, the 75 psi, and the elliptical design electromagnetic pump inlet transition pieces. Cavitation parameters with the corresponding minimum inlet pressures necessary to prevent cavitation are listed for the full-scale pump. (auth)

Radiography

2890
STUDY OF THE COMPRESSION OF DENSE MEDIA BY RADIOGRAPHY OF A UNIQUE SHOCK WAVE. Jean Dapoigny, Jean Kieffer, and Boris Vodar. Compt. rend. 245, 1502-5(1957) Oct. 28. (In French)

A method is presented for the study of the compression of dense media using instantaneous radiography and the shock wave produced by lateral expansion of gas from an explosion. Quantitative results are given for methyl methacrylate polymer. (tr-auth)

2891
REFINEMENTS IN RADIOGRAPHIC TECHNIQUES. Harold S. Wyckoff (Triplett & Barton, Inc., Wichita, Kan.). Non-Destructive Testing 15, 336-9, 354(1957) Nov.-Dec.

2892
INFLUENCE OF ABSORPTION DISCONTINUITIES ON RADIOGRAPHS MADE WITH MASKING TECHNIQUES. H. K. Herglotz (Tech. Univ. in Vienna, Austria). Non-Destructive Testing 15, 356-8(1957) Nov.-Dec.

The difficulties in x radiography arising from the characteristic absorption of an imbedding fluid can be avoided in some cases by proper choice of solution. Uniform film exposure can be obtained behind samples of constant thickness but composed of different layers of Al and uranyl nitrate solution. This was shown to be true up to tube voltages of 100 kvp. (auth)

Waste Disposal

2893
OUTLOOK FOR WASTE DISPOSAL. Nucleonics 15, No. 11, 155-64(1957) Nov.

A survey of experts in the field of waste disposal is presented. Agreement was unanimous that a permanent plan for final disposition of these wastes will be found. (L.T.W.)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

2894 AD-79207
Linden Labs., Inc., State College, Penna.
STUDY OF THE DEGRADATION OF HIGH K CERAMIC DIELECTRICS. Quarterly Report No. 10. W. R. Buessem, P. A. Marshall, Jr., and W. A. Weyl. Sept. 15, 1955. 55p. Contract DA-36-039-SC-42679.

The object is the development of ceramic dielectric materials suitable for use as capacitor dielectrics over wide temperature ranges and which have a life of at least 10,000 hours under working stresses of from 30 to 60 v per mil. Those ceramic dielectric materials which have a dielectric constant greater than 12 will be considered to be Hi-K materials. (W.L.H.)

2895 AD-121940
Ohio State Univ. Research Foundation, Columbus.
FINAL SUMMARY REPORT FOR THE PERIOD MARCH 18, 1953 TO NOVEMBER 30, 1955. Martin H. Leipold, Wilfrid R. Foster, and Thomas S. Shevlin. Feb. 15, 1956. 148p. RF Project 565. Contract NObs-62161.

The resistance to corrosion of a number of selected metal, ceramic, and cermet materials was determined by the use of a corrosion test involving partial immersion of specimens in molten, synthetic, residual fuel-oil ashes in such a manner that effects of corrosion by melt, vapor, and melt-vapor interface were revealed. Studies were made of the synthetic ashes through the application of phase equilibrium principles. Previously unknown compatibility relationships and internal reactions existing within the ashes were determined. Moreover, the specific corrosive constituents within the ashes were isolated and found to be two oxygen-deficient complex vanadyl-vanadates, a mixture of sulfur-bearing gas, and Na_2SO_4. The latter may not be a direct corrodent. Hitherto un-

reported x-ray and mineralogical data for the constituents identified during this study are given. Several investigations were made to determine the practicability of various methods of coating application and usefulness of coating materials. A satisfactory furnace providing for a rapid firing cycle was developed and is fully described. Application techniques were proposed for use with high density powders. Finally, very promising materials, chromium silicides high in chromium, were found to have application as coatings in addition to their excellent resistance to corrosion. These materials were under development and seem to offer excellent prospects, if application techniques are developed further. (auth)

2896 AECU-3577

[Los Alamos Scientific Lab., N. Mex.].

A STUDY OF PROCESS VARIABLES IN BARIUM TITANATE CERAMICS. J. J. Rosenthal and S. D. Stoddard. [1957]. 32p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00(mf OTS).

Three commercially available barium titanate powders were employed in this study. These three materials were fabricated into discs suitable for electrical measurements. Several steps in the fabrication process were varied in an attempt to determine optimum conditions for obtaining the best electrical properties for the given material. Calcination, particle size, grinding technique, binder addition, forming method, forming pressure, maturing temperature, firing cycle, cooling cycle, and setter materials were the variables investigated. The effect of these variables on dielectric constant, planar coupling coefficient, density, and firing shrinkage of barium titanate is reported. (auth)

2897

CHARACTERIZATION OF SINTERABLE OXIDE POWDERS. I. BeO. J. F. Quirk, N. B. Mosley, and W. H. Duckworth (Battelle Memorial Inst., Columbus, Ohio). J. Am. Ceram. Soc. 40, 416-19(1957) Dec.

The discovery of readily sinterable BeO powder facilitated the production of dense, high-strength BeO ceramics and created interest in the properties and preparation of sinterable BeO. BeO powders prepared by the thermal decomposition of $Be(OH)_2$ were studied in an effort to relate sinterability with other more basic characteristics of the oxide powder. Different BeO powders made from analyzed hydroxides showed a wide range of sinterability. The temperatures required for sintering the powder compacts to theoretical density ranged from 2300° to above 3200°F. Lattice parameters, thermal decomposition, surface areas, and refractive indices were determined on these powders after calcination in air at 750°, 1470°, 1830°, and 2190°F. Although unexpected variations in these properties were observed, no simple relation with sinterability was found. Occluded and surface impurities appeared to have a critical effect on sintering behavior. (auth)

2898

PREDICTING THE THERMODYNAMIC STABILITIES AND OXIDATION RESISTANCES OF SILICIDE CERMETS. Alan W. Searcy (Univ. of California, Berkeley). J. Am. Ceram. Soc. 40, 431-5(1957) Dec.

Available information on the thermodynamic stabilities of transition metal silicides is summarized and is used to demonstrate the calculation of the stability of silicide-metal mixtures. The cause of the outstanding oxidation resistance of certain silicides is analyzed, and the results are used to predict high oxidation resistance for several untested disilicides. Thermodynamic and structural arguments are applied to the prediction of compositions of thermodynamically stable and oxidation-resistant cermets. (auth)

Corrosion

2899 ANL-5195(Rev.)

Argonne National Lab., Lemont, Ill.

FACTORS WHICH AFFECT FORMATION AND DEPOSITION OF TRANSPORT CORROSION PRODUCTS IN HIGH-TEMPERATURE RECIRCULATING WATER LOOPS. C. Wohlberg and F. W. Kleimola. Dec. 1953. Decl. Feb. 7, 1957. 78p. Contract W-31-109-eng-38. $0.55(OTS).

Deposits of corrosion products form on heat transfer surfaces and in radiation flux zones at temperatures around 500°F in stainless steel systems operating with circulating water. The report considers the possible harmful effects of such deposits on heat transfer and fluid flow, as well as factors involved in the origin of these corrosion products and in the mechanisms of deposition. The prevention of deposition by chemical, mechanical, and electrostatic methods is discussed. (auth)

2900 BMI-874

Battelle Memorial Inst., Columbus, Ohio.

CORROSION OF URANIUM ALLOYS IN HIGH-TEMPERATURE WATER. H. A. Pray and W. E. Berry. Oct. 5, 1953. Decl. June 18, 1957. 36p. Contract W-7405-eng-92. $6.30(ph OTS); $3.00(mf OTS).

In the search for a corrosion-resistant high-uranium-content alloy for use as core material in high-temperature-water-moderated reactors, the corrosion of binary and ternary U alloys was studied in water at 500 and 600°F. Alloys containing less than 40 wt. % Zr additions completely oxidized upon short exposure at 600°F, whereas 50 plus wt. % alloys exhibited relatively low corrosion rates. Alloys were sensitive to heat treatment and were most resistant in the quenched condition. The corrosion rates of Zr alloys were linear to slightly accelerated with respect to time. Alloys containing 40, 50, and 60 wt. % Zr were resistant to water at 500°F. Molybdenum additions (arc-melted alloys) in the range of 10 to 15 wt. % improved the resistance of U to 600°F water but did not result in corrosion-resistant alloys, probably because of inhomogeneity of the alloys studied. The addition of Mo, Nb, Th, Sn, and Ti to uranium–20 wt. % zirconium resulted in several promising alloys: uranium–20 zirconium–5 molybdenum and uranium–20 zirconium–10 niobium. Additions of up to 5 wt. % Mo did not improve the resistance of 40 and 50% Zr alloys to 600°F water. A uranium–30 zirconium–5.6 tantalum alloy also exhibited promising resistance to 600°F water. Other additions (2 and 5 at. %) which did not improve the resistance of uranium–30 wt. % zirconium were: Sb, Bi, Ce, Cr, Co, Fe, Pb, Ni, Nb, Si, Th, Ti, and W. (auth)

2901 TID-10021

North American Aviation, Inc., Downey, Calif.

DISSOLUTION AND DISTRIBUTION BY LIQUID SODIUM OF ACTIVATED TYPE 347 STAINLESS STEEL. A. M. Saul. Mar. 15, 1954. Decl. Mar. 19, 1957. 26p. Contract AT-11-1-GEN-8. (NAA-SR-284). $0.30(OTS).

The distribution by Na of the radioactive elements of Type 347 stainless steel was studied under dynamic conditions using convection-diffusion capsules operating between 300 and 700°C. The nuclides identified as depositing on the initially inactive walls of these capsules are Ta^{182}, Fe^{59}, Co^{60}, Cr^{51}, and Mn^{54}. Deposition of these activities does not seem to be a function of capsule wall temperature alone. It was found that the presence of O_2 greatly accelerates the transfer of activity. (auth)

2902 WAPD-RM-37

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EVALUATION OF TESTS FOR CLASSIFICATION OF

ZIRCONIUM FOR CORROSION RESISTANCE. D. M. Wroughton, P. Cohen, and D. J. DePaul. Jan. 19, 1951. Decl. Mar. 11, 1957. 9p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

Recent studies show that 20 to 30% of the Zr which passes the two week water classification test at 600°F fails in 50 to 60 days on continued testing. About 5% shows serious failure. Work has been started to study the feasibility of testing Zr in water at 680°F with the hope that the metal surviving a short-time test at this temperature would withstand 600°F water for an extended period of time. (auth)

2903 WAPD-RM-194

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

CORROSION OF SOME REACTOR STRUCTURAL MATERIALS AT 600°F. B. G. Schultz and P. Cohen. Sept. 28, 1953. Decl. Mar. 7, 1957. 14p. Contract AT-11-1-gen-14. $3.30(ph OTS); $2.40(mf OTS).

Results are presented of 1000 hr dynamic corrosion tests of a variety of reactor structural materials in water under the following conditions: temperature 600°F; pressure—2000 psi; velocity past the specimens—20fps; inhibitor—100 cc dissolved H_2 per kilo of water. (auth)

2904

PASSIVITY OF TITANIUM IN HYDROCHLORIC ACID SOLUTION. Rikuro Ōtsuka. J. Sci. Research Inst. (Tokyo) 51, 73-4(1957) June.

Titanium hydride formed on the surface of titanium in hydrochloric acid solution shows passivation. Protecting effect of the hydride against the acid is due to its passivity. (auth)

2905

TITANIUM COATING AND ITS APPLICATION. II. A FURTHER STUDY ON TITANIUM CEMENTATION AND CORROSION-RESISTANCE AT NORMAL AND ELEVATED TEMPERATURES. Takashi Yamaguchi and Takeshi Takei. J. Sci. Research Inst. (Tokyo) 51, 75-81(1957) June.

Alloy coatings of Ti-containing binary alloy powders with Si, Ni, Cr, and Al were studied. Corrosion test and electrode-potential measurement showed that Ti-coated materials are nearly as corrosion-resistant as titanium in aqueous medium but less resistant at elevated temperatures. Scaling-resistant properties of Ti and Ti-Al-coated specimens, together with other resistant materials, were examined in air, hydrogen sulfide and sulfur dioxide. (auth)

2906

AQUEOUS CORROSION LOOP. Nuclear Power 2, 525-6 (1957) Dec.

A description is given of the new Harwell aqueous corrosion loop for homogeneous reactor development. (W.L.H.)

2907

CORROSION OF METALS BY HYDROGEN SULFIDE AT HIGH TEMPERATURES. Kh. L. Tseitlin, L. V. Merzloukhova, and V. A. Strunkin (Inst. of Organic Semi-Products and Dyes). Zhur. Priklad. Khim. 30, 1553-8(1957) Oct. (In Russian)

Dry hydrogen sulfide induced considerable corrosion in carbon steel at 250°C temperature with a sharp increase at 500°C. The corrosion of stainless steel began at 360°C, and Al–Fe and Al–Cr–Fe alloys at 500°C. The corrosion of Cu began at 170°C. In some cases water vapor slowed down the corrosive effects of hydrogen sulfide at high temperatures. A strong dilution of hydrogen sulfide with nitrogen weakens its corrosive effects on stainless steel and copper; however, this does not hold at a temperature of 500°C. At high temperature steels and steel alloys corrode faster in dry chloride than in dry hydrogen sulfide, while in presence of water vapors the picture is reversed. (R.V.J.)

2908

SYMPOSIUM ON CORROSION FUNDAMENTALS. A SERIES OF LECTURES PRESENTED AT THE UNIVERSITY OF TENNESSEE CORROSION CONFERENCE AT KNOXVILLE ON MARCH 1, 2, 3, 1955. Anton de S. Brasunas and E. E. Stansbury, eds. Knoxville, University of Tennessee Press, 1956. 260p.

The following papers were presented at the symposium on corrosion fundamentals at the University of Tennessee on March 1 to 3, 1955: corrosion and metal structures; nature of corrosion; atmospheric corrosion; coatings for atmospheric corrosion protection; high temperature corrosion; liquid metal corrosion; principles of cathodic protection; corrosion problems in steam power and industrial boiler plants; corrosion failures in chemical plants; inhibition of metallic corrosion in aqueous media; passivation of stainless steel; the influence of mechanical factors on corrosion; geometric factors in electrical measurements relating to corrosion and its prevention; cathodic protection principles and system design; and the use of plastics and plastic liners for corrosion protection. (W.L.H.)

Geology and Mineralogy

2909 BM-IC-7811

Bureau of Mines.

MINING METHODS AND COSTS, CALYX NOS. 3 AND 8 URANIUM MINES, TEMPLE MOUNTAIN DISTRICT, EMERY COUNTY, UTAH. W. L. Dare. Apr. 1957. 39p.

Descriptions are given of the Calyx No. 3 mine operated by American Leduc Uranium Corp. and Calyx No. 8 operated by Cline Co. The deposits are composed of numerous small, irregular bodies and are worked through 36 inch Calyx drill holes. The U–V ores are concentrated chiefly in the lower 30 feet of the Moss Back sandstone. In general it follows the strata. The mine is worked by open stoping with random pillar support. The operations and mining practices of these two mines are very similar and typify the mining methods and practices used by many small U producers on the Colorado Plateau. (R.V.J.)

2910 HW-51277

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CHANGES IN THE HANFORD WATER TABLE, 1944-1957. W. H. Bierschenk and M. W. McConiga. July 9, 1957. 21p. Contract W-31-109-Eng-52. $0.75(OTS).

Maps showing generalized contours on the water table at Hanford indicate that throughout most of the area the general movement of ground water under natural conditions is from areas of recharge in the Rattlesnake Hills northeastward and eastward to the Columbia River. Open waste disposal swamps at the chemical processing plant areas have received approximately 26.6 billion gallons of process water since startup through June 1957, and covered disposal cribs and trenches have received approximately 2.8 billion gallons of low-level radioactive wastes. With artificial recharge of waters from chemical processing plants to underlying aquifers, the water table has undergone significant changes. Of major importance is the formation of two separate and distinct ground-water mounds which have raised the water table considerably, increasing and locally reversing the natural hydraulic gradients. Through the years, the eastern mound has risen a known maximum of about 25 feet and the western

mound a known maximum of about 90 feet. The size and shape of these mounds have fluctuated depending upon the locations of disposal sites and the rates and total volumes of waste water disposed. The relative size and shape of the mounds reflect differences in the hydraulic characteristics of the receiving aquifers. (auth)

2911
THE URANIUM CONTENT OF A IRON METEORITE AND ITS AGE. F. Hernegger and H. Winke. Z. Naturforsch. 12a, 759-62(1957) Oct. (In German)

2912
A NEW METHOD FOR THE DETERMINATION OF VERY SMALL AMOUNTS OF URANIUM AND ITS APPLICATION IN THE URANIUM ANALYSIS OF STONE METEORITES. K. H. Ebert, H. König, and H. Winke. Z. Naturforsch. 12a, 763-5(1957) Oct. (In German)

2913
PHOTOGEOLOGIC MAP OF THE PARIA SW QUADRANGLE, KANE COUNTY, UTAH, AND COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-263. A. B. Olson. Washington, U. S. Geological Survey, 1957. $0.50.

Metals and Metallurgy

2914 AD-129762
Battelle Memorial Inst., Columbus, Ohio.
BIBLIOGRAPHY ON THE METAL MOLYBDENUM. July 15, 1954. 96p. Project NR 039-003. Contract N9onr-82100.

2915 AECL-458
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE PREPARATION OF PLUTONIUM–ALUMINUM ALLOYS. O. J. C. Runnalls. Dec. 1953. 18p.
Based on CRC-502; CRC-503; CRC-525; and CRC-536.
The preparation of Pu–Al alloys by the direct reduction of PuF_3 and PuO_2 with liquid aluminum is described. Experimental fuel rods for the Canadian Heavy Water Reactor (NRX) at Chalk River have been prepared using both processes. PuF_3 is reduced more rapidly at 900°C than at 1100°C with liquid Al, owing to the evolution of gaseous AlF, which is stable at the former temperature. The Pu yield for this process averaged 95% in alloying 337 g of Pu. Alloys for the second fuel rod were prepared by the Al reduction of a pressed PuO_2-cryolite mixture at 1100°C, with a Pu yield of 98 per cent. The intermetallic compounds $PuAl_2$, $PuAl_3$, and $PuAl_4$ have been prepared and examined by X-ray-diffraction methods. $PuAl_2$ and $PuAl_4$ are isomorphous with the corresponding U–Al compounds. $PuAl_3$ differs slightly from the UAl_3 type structure. Single crystals of $PuAl_3$ have been prepared, and the X-ray data obtained from them have been used to construct a unit-cell model. (auth)

2916 AECU-3587
Illinois. Univ., Urbana.
ISOTHERMAL ANNEALING BELOW 60°K OF DEUTERON IRRADIATED NOBLE METALS. Technical Report No. 11. G. D. Magnuson, W. Palmer, and J. S. Koehler. Sept. 1957. 51p. Contract AT(11-1)-102. $7.80(ph OTS); $3.30(mf OTS).
The major experimental results found in this experiment are as follows: The annealing spectrum in very pure noble metals is simple. In the 15°K to 80°K range it consists of a number of small peaks followed by a large peak. These peaks in the activation energy spectrum are reasonably discrete. If one assumes that several point defects are produced per primary and that the separation distances of these defects are of the order of two to ten or twenty lattice parameters then it is not too surprising to find some spread in the activation energies, especially since the spread is only of order 0.01 ev. The frequency factor (A/a) is large having a value in the range between 7.2×10^{10} and 3.9×10^{12} for both copper and silver. The Debye characteristic temperature decreases on irradiation. For copper the decrease after 2.5×10^{18} deuterons per cm^2 was 15°K, for silver the decrease was 10°K. Most of this change anneals out on warming to 50°K. Alloying tends to make the annealing more nearly a continuous process with a wide range of activation energies. No large low temperature drop in resistivity was found for pure gold in the range 12°K to 50°K. (auth)

2917 AERE-ES/M-9
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CLEANING SCHEDULES FOR STAINLESS STEEL TO BE USED IN THE CONSTRUCTION OF NUCLEAR REACTORS. J. H. Clarke. Mar. 7, 1956. 13p.
The tests carried out to find a simplified cleaning schedule for stainless steel which can be used as an alternative to the present specification are outlined. A treatment specifying that the stainless steel be kept in contact with 25% v/v sulfuric acid at 16°C for 24 hours is recommended but only when it is impracticable to carry out the present A.E.R.E. specification. (auth)

2918 AERE-M/M-175
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME EXPERIMENTS ON ENAMELLING ALUMINIUM. O. Flint. 1957. 4p.
Some details for the preparation of low melting point enamels are given. The application of these to aluminium surfaces to yield adherent films is described. (auth)

2919 AERE-M/R-1608
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PRECISION VACUUM CASTING OF PIPPA TYPE BARS. H. Lloyd and A. Symonds. Feb. 7, 1955. 23p. (TRDC-P/109).
Using otherwise standard vacuum techniques, PIPPA type U bars were cast in Cr plated mild steel moulds with alumina and benzene smoke for the mould dressing. The "as cast" surface finish of the bars, particularly those from the smoke dressing, was superior to any previously obtained. In view of the diametral consistency between bars and along the length of individual bars and the high quality surface finish, machining may be unnecessary. This consideration and the extended life of these moulds by comparison with alternative materials make their use economically attractive. (auth)

2920 ANL-5519
Argonne National Lab., Lemont, Ill.
ARC MELTING OF ZIRCONIUM METAL. Richard J. Dunworth. Oct. 1957. 32p. Contract W-31-109-eng-38. $1.00(OTS).

2921 ANL-5581
Argonne National Lab., Lemont, Ill.
CONSTITUTION OF THE URANIUM-RICH U–Nb AND U–Nb–Zr SYSTEMS. Final Report—Metallurgy Program 3.1.5. A. E. Dwight and M. H. Mueller. Oct. 1957. 74p. Contract W-31-109-eng-38. $2.00(OTS).
The uranium–niobium binary system exhibits a continuous series of solid solutions above 650°C. At lower temperatures a miscibility gap exists, containing a niobium-rich and a uranium-rich body-centered cubic phase. A

monotectoid transformation occurs at 634°C. The β-uranium phase is restricted by niobium and disappears at 4 wt. % Nb. Below 634°C α uranium and the niobium-rich gamma co-exist. The uranium–niobium–zirconium ternary system exhibits a continuous series of solid solutions at high temperatures. Miscibility gaps in the uranium–niobium and uranium–zirconium binary systems close with addition of the third element. Addition of both zirconium and niobium stabilizes the body-centered cubic gamma phase to lower temperatures. The β-uranium phase is eliminated in ternary alloys of 4 wt. % Nb or more. The δ phase of the uranium–zirconium binary system extends into the ternary system to no more than 10 wt. % Nb. Over the major portion of the uranium-rich corner of the ternary system the equilibrium phases are α–U and γ solid solution. The uranium–niobium binary system is the more cominant of the limiting systems. No new ternary phases were found. The relation of microstructures to irradiation stability is discussed. The relation of lattice strain to limits of solid solubility is also discussed. (auth)

2922 BBC-53
Brush Beryllium Co., Cleveland.
PROCESS STUDIES ON ZIRCONIUM AND URANIUM; PROGRESS REPORT [FOR] PERIOD NOVEMBER 1, 1949 THROUGH MARCH 31, 1950. R. J. Bruehlman and W. W. Beaver. Apr. 21, 1950. Decl. Apr. 8, 1957. 123p. Contract AT-(30-1)-510. $0.70(OTS).

Development work derived from vapor-phase reduction of halides by sodium and derived from the extraction of zirconium from zirconium ores as ammonium zirconium fluoride which is decomposed to zirconium fluoride and reduced with magnesium and/or sodium to zirconium metal is reported. (J.E.D.)

2923 BMI-754
Battelle Memorial Inst., Columbus, Ohio.
EXPERIMENTAL FABRICATION OF A LIGHTWEIGHT CONTROL ROD. H. A. Saller, J. T. Stacy, and D. L. Keller. July 1, 1952. Decl. Mar. 20, 1957. 35p. Contract W-7405-eng-92. $0.35(OTS).

The possibility of fabricating a lightweight control rod from one of several high cross-section materials was investigated. The major effort was directed toward the development of a titanium-clad rod containing a composite core of 25 weight per cent Gd_2O_3 in a matrix of titanium. Experimentation on both subscale and full-scale control-rod cores showed that the fabricating behavior of the two was not analogous. To roll the fullscale core successfully, it was necessary to lower the oxide content to 17 weight per cent. Subscale investigations were also carried out on titanium-cadmium, titanium-lanthanum, and titanium-gadolinium alloys. (auth)

2924 BMI-780(Del.)
Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL PROPERTIES OF IODIDE ZIRCONIUM ALLOYS. A. D. Schwope and W. Chubb. Nov. 1, 1952. Decl. with deletions May 7, 1957. 21p. $4.80(ph OTS); $2.70(mf OTS).

The tensile properties, hot hardness, impact strength, and corrosion resistance of some arc-melted iodide Zr alloys were determined. The alloys investigated include binary alloys of Zr containing zero to 5% Sn and zero to 0.14% N and ternary alloys of Zr containing Sn and N, Sn and U, and U and Be. (auth)

2925 HW-50340
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ADDITIONAL OBSERVATIONS ON THE FLOW STRESS RECOVERY OF ZIRCALOY-2. Dale E. Johnson. June 6, 1957. 26p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

The flow stress recovery behavior of 5, 15 and 25% cold-worked Zircaloy-2 was studied over the temperature range of 275°C to 500°C. Activation energies were calculated for 50% recovery of 15% cold-worked material. A significant and useful portion of the strain induced strength increase is retained in 15% cold worked Zircaloy-2 after long times at temperatures up to 350°C. No significant difference was observed between the yield strengths of 15 and 25% cold-worked Zircaloy-2 after the recovery treatments. Cold working the alloy 25% did not accelerate the yield strength recovery as compared with lower per cents of cold work. Based on the data collected in this study the activation energy for 50% yield strength recovery of 15% cold worked Zircaloy-2 decreases with increasing temperature. (auth)

2926 IDO-16409
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
RADIATION DAMAGE STUDIES PROGRAM; ETR LOOP MATERIALS PROGRESS REPORT II. M.S. Robinson. Sept. 16, 1957. 33p. Contract AT(10-1)-205. $1.00(OTS).

A program has been under way at the MTR to determine changes in mechanical properties with irradiation for special alloys under consideration for use in ETR high pressure loops. Sub-size tensile and impact samples are being irradiated in the MTR, and tensile samples irradiated through four cycles have been tested for the following materials: 16-1 Croloy, Hastelloy-X, Inconel-702, Inconel-X (double aged), Inconel-X (single aged), K-Monel, 410 Stainless Steel. Nickel plated samples of 2¼ Croloy corroded too much to permit testing. All materials, with the exception of 16-1 Croloy, revealed a continual increase in yield strength and a decrease in elongation with irradiation as expected, but the ultimate tensile strength of Inconel-X and K-Monel and both ultimate tensile strength and yield strength of the 16-1 Croloy appeared to decrease with irradiation after reaching a maximum. (For preceding period see IDO-16337.) (auth)

2927 KAPL-M-CTU-10
Knolls Atomic Power Lab., Schenectady, N. Y.
RADIOACTIVE ACCESSIBILITY REPORT [FOR] MARCH AND APRIL 1954. W. W. Kendall. Decl. Feb. 25, 1957. 41p. Contract W-31-109-eng-52. $7.80(ph OTS); $3.30 (mf OTS).

Sodium irradiation experiments were made to determine the typical amounts of impurities included in Na. Diagrams are shown of the Na in-pile loop. The use of barrier coatings as a means to reduce the transport of long-lived radioactive isotopes from stainless steel reactor components in Na was investigated. The effects of increased sodium oxide concentrations on mass transfer of stainless steel were studied. Tests of Na flow in toroids were continued. Apparatus for isothermal exchange experiments is shown. Data from saturation rate experiments are included. A laboratory-scale Na loop is shown. Thermal harps were used to determine the inhibiting action of Mg, Zn, Be, Ca, and K on stainless steel mass transfer in Na. A loop system for Mg-in-Na studies is shown. (C.H.)

2928 KAPL-M-DBK-4
Knolls Atomic Power Lab., Schenectady, N. Y.
DEVELOPMENT OF PROCEDURES FOR INTERNAL BUTT WELDING OF T347 STAINLESS STEEL TUBES TO TUBE SHEETS. D. B. Kittle, K. H. Koopman, and J. M. Gerken. Nov. 4, 1957. 18p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Some good quality welds have been made by butt welding lengths of type 347 stainless steel tubing 0.402 I.D. × 0.049

in. wall thickness, and also by butt welding 3 in. lengths of this tubing to extensions on a simulated tube sheet. Therefore, it is concluded that welding of this small tubing from the inside is feasible. (auth)

2929 KAPL-M-RLM-13
Knolls Atomic Power Lab., Schenectady, N. Y.
STRAIN FATIGUE BEHAVIOR OF ZIRCALOY 2 AND 3 AT ROOM TEMPERATURE AND 550°F. R. L. Mehan, D. T. Groleau, J. H. Read, and G. J. Sokol. Nov. 18, 1957. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70 (mf OTS).

Strain-fatigue tests were performed at room temperature and 550°F on ½ in. hot-rolled and annealed plate of Zircaloy-2 and -3. Plots of total strain range, stress range, and plastic strain range versus cycles to failure were obtained. In addition, true stress-strain tests of Zircaloy-2 at room temperature and 550°F up to 2% strain were performed. (auth)

2930 NP-6481
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
NOTES OF A MEETING ON COATINGS FOR TITANIUM. Oct. 15, 1957. 36p.

An informal discussion meeting on coatings for titanium was held by the Titanium Metallurgical Laboratory at Battelle on April 18, 1957. Attendes, speakers, and subjects are listed. This report presents, in order, a summary of the information presented by each speaker and interesting points brought out in the subsequent discussions. (auth)

2931 NP-6497
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
BEND TESTS AND FORMING TESTS ON TITANIUM ALLOYS. Nov. 8, 1957. 13p.

Drop-hammer-and-trapped-rubber-forming tests were made on six commercial compositions of Ti alloy sheet. The object was to compare the formability of the alloys and to indicate the effect of temperature on their forming characteristics. Results of all tests are included. (W.L.H.)

2932 NYO-1118(Rev.)
Brush Beryllium Co., Cleveland.
PROCESS DEVELOPMENT QUARTERLY PROGRESS REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER 1952. A. J. Stonehouse. Feb. 15, 1953. Decl. Feb. 28, 1957. 35p. Contract AT(30-1)-541. $6.30(ph OTS); $3.00(mf OTS).

Development work on the fabrication of Be by powder metallurgy is described with emphasis on room and elevated temperature pressing procedures. Studies leading towards the development of Be rod with improved tensile elongation are discussed. A summary of the current work on the process metallurgy of Be including ore extraction studies is presented. Data obtained from the melting and casting of uranium in the presence of vibrational forces are also discussed. (auth)

2933 SC-4128(TR)
Sandia Corp., Albuquerque, N. Mex.
STATIC FAILURE OF AN AIRCRAFT-TYPE BEAM. W. B. Stephenson and E. R. Ripperger. Oct. 1957. 27p. Contract [AT(29-1)-789]. $4.80(ph OTS); $2.70(mf OTS).

Tip deflections of cantilever beams loaded beyond the elastic limit were computed. The stress-strain diagram for 24S-T aluminum was used in calculating the inelastic bending of beams having three different cross sections: solid rectangular, monocoque, and built-up aircraft. The calculations show that these beams can undergo large deflections before failure occurs initially by fracture of the outer fibers. Experimental studies of the bending of the aircraft-type beam show that the tip deflection of this beam when initial skin fracture occurs is 6 to 10 times the linear-limit deflection. Even after skin failure, the aircraft-type beam was able to carry 35 per cent of the maximum load supported previous to the skin failure. The results show that lethal radii based on a linear load-deflection relationship will be grossly overestimated. (auth)

2934 WADC-TN-57-247
Michigan. Univ., Ann Arbor. Engineering Research Inst.
CRYSTALLOGRAPHIC STRUCTURE AND ORIENTATION OF THE γ′ PHASE IN FOUR COMMERCIAL NICKEL-BASE ALLOYS. J. A. Amy and W. C. Bigelow. July 1957. 17p. Project 7021. Contract AF-33(616)-3250. (AD-130834).

Selected area electron diffraction patterns have been obtained from matrix precipitate particles isolated by the extraction-replica technique from aged specimens of four commercial nickel-base alloys, Inconcel-X, Waspalloy, M-252, and Udimet, which contain titanium and aluminum as hardening agents. From these patterns the matrix particles have been conclusively identified as the γ′ phase. It has also been shown that the ordered, or superlattice, structure reported for this phase in simpler alloy systems occurs also in these complex alloys, and that the particles develop with a high degree of preferred crystallographic orientation relative to the matrix lattice. Variations in the size, shape, and distribution of the particles in specimens of the four alloys aged 100 hours at 1400°F are also evident, and appear to be related to the titanium and aluminum content of the alloys. (auth)

2935 WADC-TR-55-243
Metallwerk Plansee, Reutte, Tyrol, Austria.
DEVELOPMENT OF ALLOYS HAVING GOOD HIGH TEMPERATURE PROPERTIES THROUGH POWDER METALLURGY TECHNIQUES. [Period Covered]: July 1954 to April 1955. R. Kieffer and F. Benesovsky. May 13, 1955. 111p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF61(514)-741-C. (AD-131071).

Pure TiC and TiC with Mo_2C, VC and Cr_3C_2 have been alloyed with refractory binding agents such as Fe–Al alloys with a content of 8 to 14% of Al as well as Fe–Al–Cr, Fe, Cr–Al and Fe–Al–Mo. The carbide phase has been varied from 5 to 35%. The most promising alloys found out among the 12 series of alloys consisted of a binding agent of Fe–Al with 12 or 14% of Al and of mixed crystals of TiC–Cr_3C_2 90/10. All alloys examined can be shaped to a certain extent at high temperatures. (auth)

2936 WADC-TR-56-340
Southern Research Inst., Birmingham, Ala.
DETERMINATION OF TENSILE, COMPRESSIVE, BEARING, AND SHEAR PROPERTIES OF FERROUS AND NONFERROUS STRUCTURAL SHEET METALS AT ELEVATED TEMPERATURES. Period Covered: January 1955 to March 1956. John V. Melonas and J. Robert Kattus. Oct. 1956. 307p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contracts AF33(616)-2741 and AF33(616)-3224. (AD-131069).

The tensile, compressive, bearing, and shear properties of the following sheet metals were determined at various temperatures after exposure times of from ½ to 1000 hours at the test temperature: AISI-4130 alloy steel, 150,000 psi nominal strength level; AISI-4130 alloy steel, 180,000 psi nominal strength level; AISI-4130 alloy steel, 200,000 psi nominal strength level; A110-AT titanium

alloy; HK31-H24 magnesium alloy; and Type 301 stainless steel, full-hard. The magnesium alloy was tested over a temperature range from 75 to 600°F, whereas the other test metals were tested at temperatures up to 1000°F. The test results show that all strength and modulus properties decreased to some degree with increasing temperature over the range studied. Increasing exposure time, which had no significant effects on modulus-of-elasticity values, resulted in some decreased strength properties in all test metals at the higher test temperatures but had no appreciable effect at the lower temperatures. In general, the effects of variations in temperature were greater than the effects of variations in exposure time. A correlation and comparison of the test results indicated some crude relationships between various properties. These relationships provide a means of calculating rough estimates of certain properties on the basis of a different property determination. The accuracy of these calculations decreases as the range of materials and conditions, to which they are applied, increases. For the entire range of materials and conditions used in this work the accuracy of the various property relationships ranged from ± 11% to ± 55%. Precise and reliable data on the tensile, compressive, bearing, and shear properties of aircraft-structural materials can be obtained only by testing under the desired conditions. (auth)

2937 WADC-TR-56-478
Cornell Univ., Ithaca, N. Y.
LITERATURE SURVEY OF THE CORROSION OF MAGNESIUM AND MAGNESIUM ALLOYS. [Period covered] July 1955 to November 1956. Henri S. Sack and Bryon P. Roe. Dec. 13, 1956. 159p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-3032. (AD-142008).

Features mentioned as well established are: Corrosion of Mg, except in a dry atmosphere, is galvanic in nature; the purest Mg has the lowest corrosion rate; the effect of impurities is characterized by a critical concentration, the tolerance limit, below which there is little influence of the impurity; the naturally formed films are stable only under special, and very often limited conditions and are therefore not generally protective. However, under reasonable inland atmospheric conditions, and even in fresh water, the corrosion resistance of Mg and some of its alloys is quite satisfactory. Many artificial coatings have been developed that give additional protection. Summaries are included on general corrosion behavior of Mg, experiments with Mg single crystals, test procedures, effects of temperature and other parameters, structure of surface films, effect of impurities and additions, corrosion behavior of Mg alloys, interpretation of corrosion experiments, stress corrosion, galvanic coupling corrosion, and artificial protective films. (M.H.R.)

2938 USBM-C-4
Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.
ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF JUNE 15–SEPTEMBER 15, 1954. Oct. 8, 1954. Decl. Mar. 15, 1957. 41p. Contract AT-(11-1)-140. $6.30(ph OTS); $3.00(mf OTS).

2939 WAL-142/59-6
California Inst. of Tech., Pasadena.
DESIGN AND DEVELOPMENT OF AN ELECTRONIC X-RAY PROBE FOR THE STUDY OF ALLOYS AND OF THE STRUCTURE OF METALS. Interim Technical Report No. 2. David B. Wittry. July 1954. 39p. DA Project No. 593-08-024. Contract DA-04-495-Ord-463.

Progress of work on the design and development of an electronic x-ray microprobe for the quantitative and qualitative composition measurements of about 1 cubic micron of the surface of metals and alloys is described. The principle is that first used by Castaing, wherein the metal is subjected to bombardment by a finely focused probe of electrons, and the elements present and their proportions are determined by an analysis of the frequency and intensity of the characteristic x-rays emitted. The optical system which will be used to examine the area of the sample being studied, and a proposed ionic pump are described. A more complete description of the electronic complement, stage mechanism and curved crystal vacuum spectrometer is also included in this report. (auth)

2940 WAPD-141
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
FUEL-CLAD BOND TESTING OF ZIRCALOY-2 CLAD, URANIUM-12 w/o MOLYBDENUM FUEL RODS. H. J. Snyder. Feb. 15, 1956. Decl. Aug. 12, 1957. 33p. Contract AT-11-1-GEN-14. $1.00(OTS).

Fuel-clad bond testing of Zircaloy-2 clad, U–12 wt. % Mo fuel rods is discussed. Qualitative and quantitative bond testing procedures are described and specific test data presented. The data indicate that microscopic observation of the bond line growth resulting from a one hour, 800°C (1472°F) heat treatment is a satisfactory method for qualitatively determining the nature of the fuel-clad bond. A metallurgical fuel-clad bond appears to grow 0.0009 in. (nominal) in response to the 800°C (1472°F) heat treatment. Quantitative bond integrity can be satisfactorily determined by tensile shear testing. A metallurgical bond has a shear strength of approximately 44,400 psi. (auth)

2941 WAPD-FE-81
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REPORT OF PWR EXPERIMENT 11c2: THE EFFECT OF ZIRCONIUM CONTENT ON ROD TYPE ELEMENTS. J. Halapatz. Sept. 2, 1954. Decl. Mar. 19, 1957. 16p. $3.30(ph OTS); $2.40(mf OTS).

Described is the experimental fabrication by extrusion of rods with the nominal dimensions 0.5 in. O.D., 0.050 in. Zircaloy-2 clad thickness, containing 2, 5, 10, 15, and 20% Zr–HEW U cores of 0.390 in. diameter. Poor composite geometry and unacceptable dimensioning were observed in the extrusions which may be attributed to unsatisfactory core alloys. No significant differences in core configuration or clad uniformity were noted among the alloys. Rod sections bearing each core alloy will be corrosion tested to observe the type of failure. (auth)

2942 WAPD-FE-132
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
ZIRCONIUM COST REDUCTION PROGRAM. PART III-THE ZIRCONIUM SCRAP PROBLEM. K. M. Goldman. June 30, 1954. Changed from OFFICIAL USE ONLY Sept. 19, 1957. 29p. $4.80(ph OTS); $2.70(mf OTS).

Various methods of Zr scrap reclamation are reviewed. (L.T.W.)

2943 WAPD-FE-956
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
THE EFFECT OF RESIDUAL COLD WORK AND STRAIGHTENING METHOD ON SOME MECHANICAL PROPERTIES AND FAILURE CHARACTERISTICS OF ZIRCALOY-2 TUBING. L. C. Cochrun. Aug. 23, 1955. Decl. Mar. 19, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

It is concluded that the effect of cold work in the range 4 to 24% is so small as to be insignificant (with respect to normal material variation). A substantial improvement in

properties is obtained by introducing at least 4% cold work, and severe straightening has little or no effect. It is recommended that residual cold work be specified as 5 to 15%. (L.T.W.)

2944 WAPD-FE-978

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

QUALITATIVE EFFECT OF CONCENTRIC GROOVES ON FRACTURE CHARACTERISTICS OF ZIRCALOY-2 TUBES. K. M. Goldman. Sept. 1, 1955. Decl. Mar. 20, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

Concentric grooves were cut in the vicinity of the heat-affected zone of several tubes. In one instance grooves were cut on the inside. Also one of the tubes was knurled on the heat-affected zones. Apparently grooves cut as concentric rings in the heat-affected zone do not affect bursting strength, area of fracture, or the characteristic of the rupture. Neither do they arrest cracks nor minimize bulging in the heat-affected zone. (L.T.W.)

2945 WAPD-T-24

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE SOLID SOLUBILITY OF TIN IN ALPHA ZIRCONIUM. G. R. Speich and S. A. Kulin. Sept. 23, 1952. 24p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

The solid solubility of Sn in the α or hexagonal or close-packed modification of Zr was investigated over a wide temperature range by two methods. At high temperatures the Sn solubility was determined by x-ray techniques, and at low temperatures the solubility determinations were performed by a strain-aging method. (L.T.W.)

2946 WAPD-T-176

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

ELECTRICAL RESISTANCE OF ZIRCONIUM AND TITANIUM. W. A. Bostrom. Apr. 14, 1954. Changed from OFFICIAL USE ONLY Sept. 19, 1957. 13p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The electrical resistance of Zr and Ti was studied as a function of purity over the temperature range −196 to +1000°C. It was observed that higher purity materials had lower resistances at all temperatures employed. The temperature coefficients of resistivity were observed to be independent of purity. (auth)

2947 WAPD-T-240

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EQUIPMENT AND PROCEDURES FOR INERT ATMOSPHERE WELDING OF ZIRCONIUM AND HAFNIUM. J. S. Theilacker, E. D. Baugh, A. H. Kasberg, and R. B. Stermon. [1955?]. 12p. $3.30(ph OTS); $2.40(mf OTS).

Considerable work has been done over the past five years at the Westinghouse Atomic Power Division on the development of methods and equipment for welding Hf and Zr for nuclear reactor applications. Problems related to welding chamber materials and design, chamber vacuum equipment, remote operation of heliarc torch mechanism and lubrication of moving parts have been solved. In addition, methods for welding Zr, Zr alloys and Hf have been established resulting in quality welds of excellent mechanical properties and corrosion resistance in high temperature, high pressure, water. (auth)

2948 WAPD-T-314

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

APPLICATION OF ZIRCONIUM IN ATOMIC ENERGY. B. Lustman. Feb. 15, 1956. 24p. $4.80(ph OTS); $2.70 (mf OTS).

The properties of Zr and Zircaloy which render them desirable for reactor application are reviewed. Deficiencies which may limit ultimate application are also discussed. The potential magnitude of the zirconium market in relation to price, quality, and availability is reviewed. (auth)

2949 WIN-85

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

THE USE OF POWDERED SPECIMENS FOR STUDYING THE KINETICS OF DISSOLUTION. Walter E. Schortmann and Michael A. DeSesa. Nov. 18, 1957. 34p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

Because of the difficulty involved in preparing massive specimens, the feasibility of using powdered material in kinetic studies of liquid-solid systems was investigated. It was shown that, contrary to published opinion, the powder method for studying the dissolution of solids is as valid as the massive specimen technique. Consequently, the advantages of using a fine powder warrant consideration of its use in studying the kinetics of these heterogeneous systems. The main advantages are ease of sample acquisition and preparation and simplicity of experimental procedure. (auth)

2950

DESIGN AND MANUFACTURE OF FUEL ELEMENTS. Atomics 8, 467-71(1957) Dec.

The design and fabrication of reactor fuel elements by Babcock and Wilcox Company in the USA are described. (W.L.H.)

2951

A THEORY OF THE FRACTURE OF METALS. A. N. Stroh (Univ. of Sheffield). Advances in Phys. 6, 418-65(1957) Oct.

2952

THE PREPARATION OF Zr AND Zr ALLOYS BY ELECTROLYSIS. Jean-Lucien Andrieux and Jeanne Dauphin. Compt. rend. 245, 1359-62(1957) Oct. 21. (In French)

2953

ON THE USE OF TRITIUM FOR RADIOGRAPHIC INVESTIGATION OF HYDROGEN DISTRIBUTION IN TITANIUM AND ZIRCONIUM. B. I. Bruk and G. I. Nikolaev. Doklady Akad. Nauk S.S.S.R. 116, 78-80(1957) Sept. 1. (In Russian)

Tritium diagrams made with Ti and Zr specimens revealed a certain regularity in the H distribution in Ti and Zr base alloys. Radiograms pointed out an even uniform H transition from the basic metal to the welding seam metal, without any appreciable hydride phase concentrations on the alloyed boundary line. (R.V.J.)

2954

ANODIC POLARIZATION OF NEUTRAL ELECTROLYTES OF ALLOYS OF ALUMINUM WITH ALKALINE EARTH ELEMENTS. A. L. Seifer. Doklady Akad. Nauk S.S.S.R. 116, 120-2(1957) Sept. 1. (In Russian)

The anodic polarization of high purity Al alloyed with Ca, Sr, and Ba was studied in sea water and in 0.5N solutions of NaCl and Na_2SO_4. The results are presented graphically. (R.V.J.)

2955

INDIUM-RICH INDIUM–MAGNESIUM AND INDIUM–LITHIUM ALLOYS. J. Graham and G. V. Raynor (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 1354-63(1957) Nov.

For comparison with the results obtained from alloys of In with solute metals from Group IIB of the periodic table, the lattice spacings of In–Mg and In–Li alloys have been measured. Although the results show an unexpected scatter, they establish that neither Mg nor Li cause a marked axial ratio decrease. A possible reason for this behavior is briefly discussed. The solid solubility of Mg in In at

room temperature lies between 35 and 40 atm. % of Mg. The primary solid solution enters into equilibrium with the previously observed face-centered cubic intermediate solid solution (denoted β) above 275°C, and with the ordered form of the same intermediate phase below this temperature. There is a peritectic reaction β + liquid ⇌ (indium-rich primary solid solution) at 333.5°C. (auth)

2956

STEP-TYPE DEMOUNTABLE METAL VACUUM JOINT. W. J. Lange and D. Alpert (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr. 28, 726(1957) Sept.

PHYSICS

2957 AERE-C/M-205

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ALKALI MELTS—THE MELTING POINT OF TWO COMPONENT SYSTEMS CONTAINING CAUSTIC SODA. J. R. Findlay, J. N. Gregory, J. V. G. Iredale, and G. J. Weldrick. May 4, 1954. 13p.

Phase relationships, arising from the addition of other low neutron capture compounds to caustic soda, have been examined with the primary object of discovering low-melting mixtures, suitable for use in homogeneous reactors. Lithium hydroxide gives a eutectic at 22% LiOH, with a m.p. 100°C lower than pure caustic soda. Sodium sulfate and carbonate also give eutectics with appreciable lowering of m.p. The former, however seems rather corrosive to nickel. The addition of sodium fluoride or sodium pyrophosphate to caustic soda gives little or no depression of the m.p. and the system containing silicate appears rather complex and of little value. (auth)

2958 AERE-ES/R-2142

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RESIN CASTING SYSTEM AND METHODS. T. P. Lynott, R. P. Dawson, and G. H. Barnes. May 1, 1957. 79p.

2959 AERE-M/M-73

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SINTERING OF THE SOLID PHASE IN LIQUID/SOLID SYSTEMS. J. Williams. June 14, 1954. Decl. Apr. 29, 1957. 9p.

Two methods can be adopted to prevent sintering of the solid particles in a slurry. If there is complete wetting of the solid by the liquid then the particles will be separated by a liquid film. Such a system is believed to be the most stable with respect to sintering. The strength of the interparticle liquid film and methods of promoting wetting are discussed. By raising the melting-point of the solid phase, the resistance to sintering at any one temperature is increased. Compounds of the fissile element with both metals and non-metals are best suited to this purpose. Surface layers of these compounds upon the pure fissile element are probably unstable, tending to coalesce. If there is solubility of the solid in the liquid phase, then growth of the solid particles, by means other than sintering, is to be anticipated. (auth)

2960 BNL-455

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] APRIL 1–JUNE 30, 1957. 44p. $1.50(OTS).

Abstracts of reports on physics, chemistry, nuclear engineering, biology, and medicine submitted for publication are presented. Research activities which have not reached the stage for publication are reported. The status of operations in the Cosmotron, the accelerator, the reactor, and the instrumentation and health physics departments is summarized. (For preceding period see BNL-439.) (M.H.R.)

2961 CF-56-8-155

Oak Ridge National Lab., Tenn.

HEAT CAPACITY OF COMPOSITION NO. 30 WITH SIMULATED FISSION PRODUCTS. W. D. Powers and G. C. Blalock. Aug. 21, 1956. Decl. July 5, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The enthalpy and heat capacity of Composition No. 30 ($NaF-ZrF_4-UF_4$; 50–46–4 mole %) were determined with and without the addition of fluoride salts (RbF, BaF_2, LaF_3) simulating fission products. (L.T.W.)

2962 CF-57-1-21

Oak Ridge National Lab., Tenn.

OPERATION OF IN-PILE LOOP L-4-12. F. J. Walter. Jan. 7, 1957. 15p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Loop L-4-12 was the seventh corrosion test loop operated in HB-4 beam hole at the LITR. The loop was inserted on January 24, 1956, and removed on April 17, 1956. This loop had a titanium core which was attached to the 347 stainless steel loop with special titanium to stainless steel couplings. (auth)

2963 MLM-CF-57-10-31

Mound Lab., Miamisburg, Ohio.

NUCLEAR BATTERY—THERMOCOUPLE TYPE THIRD QUARTERLY REPORT [FOR] JULY 1, 1957 TO SEPTEMBER 30, 1957. Bertram C. Blanke. Sept. 30, 1957. 16p. Contract R-50-799965-SC-01-91.

A second thermoelectric generator consisting of unitized rings of thermopiles was designed and constructed. Three and four rings were assembled into generators and tested. A maximum efficiency of 0.67% was obtained. At a ΔT of 400°C, an efficienty of 0.56% was obtained; the theoretical maximum for the materials used is 0.83%. (auth)

2964 ORNL-2413

Oak Ridge National Lab., Tenn.

SOLID STATE DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1957. Nov. 26, 1957. 133p. $3.50(OTS).

Two experiments on the precipitation-hardening reaction in Ni–Be were completed The removal rate of conduction electrons in n-type Ge is increased during fast neutron irradiation at ~16°K over that previously observed at ~100°K. The dependence of hole lifetime in n-type Ge on irradiation was determined. The Hall mobility of fast-neutron- and γ-irradiated single-crystal plates of n-type Ge was determined from room temperature to ~50°K for a series of irradiations. A theoretical expression was obtained for the bulk absorption coefficient of Ge for light in the near-infrared region. Total-energy diagrams are presented for several substitutional impurities in Ge. A strong paramagnetic contribution to the susceptibility is evident at low temperatures in Si samples having between 5×10^{16} and 4×10^{18} As donors/cc. The temperature dependence of the magnetic susceptibility of pure Mo wire was measured. A liquid He cryostat was put into operation to permit measurement of magnetic susceptibility over the range 3 to 350°K. The hyperfine interaction of one of the magnetic defects in the quartz system with the 4.7%-abundant Si^{29} isotope (nuclear spin $I = \frac{1}{2}$) was observed. A superheterodyne spectrometer was constructed which has a sensitivity approximately 100 times greater than that of the old system

for similar operating conditions. Optical studies of crystalline quartz after Co^{60} γ irradiation indicate little if any formation of the 2150-Å C band observed after neutron bombardment. The effects of fast pile neutrons upon solid crystalline structures were observed by use of x-ray-diffraction techniques. It was observed in high-purity KCl crystals that the scattering of phonons by strains introduced by cleaving may be considerable and that thermal annealing is effective in removing such thermal resistance. The thermal conductivity of the purest available crystals of KCl, SiO_2, LiF, CaF_2, MgO, Ge, and NaF was measured at low temperatures. The thermal conductivity of fused silica at low temperatures increases by a factor of 2 after an irradiation of 5.8×10^{18} fast neutrons/cm^2, the increase being approximately linear with dose. Changes in density and in thermal conductivity were measured for ceramic materials irradiated for several operating cycles in the MTR. Spectral measurements were made on polyethylene terephthalate before and after irradiation. Samples of polymethyl methacrylate of various average molecular weights were irradiated and the molecular weights after irradiation were determined by measuring the viscosities of dilute solutions of the polymer. The radiation resistance of fluorobutyl acrylate was investigated by the usual engineering properties tests. The physical and nuclear properties of the U-bearing zeolites are presented. Postirradiation examinations were completed on two fuels, ThO_2-UO_2 and $SiC-Si-UO_2$. (For preceding period see ORNL-2188.) (M.H.R.)

2965 SCTM-227-57(51)

Sandia Corp., Albuquerque, N. Mex.

REAC CALCULATIONS FOR THE EXPLOSIVE ELECTRIC TRANSDUCER PROBLEM. W. J. Spencer. Sept. 5, 1957. 59p. Contract AT(29-1)-789. $9.30(ph OTS); $3.60(mf OTS).

General solutions of the axial and normal mode cases of explosive electric transducers are given. The results of these solutions are compared with experiments and various parameters are determined for each case. (auth)

2966

PHASE TRANSITION FOR A HARD SPHERE SYSTEM. B. J. Alder and T. E. Wainwright (Univ. of California, Livermore). J. Chem. Phys. 27, 1208-9(1957) Nov.

The method consists of solving exactly the simultaneous classical equation of motion of several hundred particles by means of fast electronic computers. (W.L.H.)

2967

THEORY OF EXCITATIONS IN LIQUID HELIUM 4. Fumihiko Takano (Tokyo Univ., Japan). J. Phys. Soc. Japan 12, 1185-94(1957) Nov.

A modified "phonon-roton" model for liquid Helium II is proposed and is shown to be connected smoothly with the theory of Bose condensation. The method used is the direct extension of the method of "auxiliary variables" used by Bogolyubov and Zubarev and is equivalent to that used by Bohm and Pines in the theory of the electron gas in metals. The phonon excitation is described in terms of the density operator, and the roton part by the so-called individual coordinates. The elimination of the kinematical interaction leads to the following model: The excitations for long wave length are described by phonons, and for short wave length by rotons, and the total number of excitations cannot exceed the total number of the particles. The thermal properties of this model are seen to agree with the experimental fact qualitatively. (auth)

2968

COMPARISON OF THE METHODS FOR MASS DETERMINATION BASED ON THE RANGE-IONISATION MEASUREMENT. B. Dobovišek. "J. Stefan" Inst. Repts. (Ljubljana) 2, 39-45(1955) May.

The accuracy in mass determination has been studied measuring gap density, gap length and photoelectric density along protons and a K-particle, ending in a nuclear emulsion. It has been shown that, although the present quantities are measured with different accuracy, the error in the mass determination is about the same by all three methods, as the measured quantities are differently sensitive functions of the ionization. (auth)

2969

ON THE ANGULAR DISTRIBUTION OF THE PARTICLES OF PHOTODISINTEGRATED CARBON. F. I. Havliček and B. Dobovišek. "J. Stefan" Inst. Repts. (Ljubljana) 2, 73-6 (1955) May.

Using a heuristic principle, there was selected a special kind of traces in photoplates of the disintegrating particles of carbon. Diagrams of the angular distribution of these are drawn. (auth)

2970

TIME-CORRELATED PHOTONS. G. A. Rebka and R. V. Pound (Harvard Univ., Cambridge, Mass.). Nature 180, 1035-6(1957) Nov. 16.

The time correlation of photons in coherent light beams is demonstrated using pulse and coincidence techniques in contrast to the continuous-wave technique used by Brown and Twiss. This experiment differs from theirs in that counts from each detector are recorded. These are used for reducing each observation to a measurement of effective resolving time. (M.H.R.)

2971

IRRADIATION FOR INDUSTRY. Nuclear Power 2, 492-518 (1957) Dec.

A collection of papers are presented on irradiation for industry. They include papers on what industry can do (now and in the future), types of radiation (characteristics and uses), machines for producing radiation (electrostatic generators and linear accelerators), radiation dosimetry (units and measurements), source irradiation units (isotope facilities), instruments for irradiation health, safety and control, the technology of ionizing radiations and how Harwell plans to develop, British gamma facilities and some irradiation sources, and British machine facilities and industrial units. (W.L.H.)

2972

THREE BETA-ABSORPTION METHODS. HOW DO THEY COMPARE? J. F. Duncan and F. G. Thomas (Univ. of Melbourne, Australia). Nucleonics 15, No. 10, 82-5 (1957) Oct.

Beta emitters can be identified by finding the β range in Al absorbers and from this, E_{max}. Three methods commonly used are compared for ease, accuracy, and sensitivity. The feather method involves comparison of the unknown's absorption curve with that of a known isotope. Apparent ranges are calculated for corresponding fractional absorptions. Since different absorption curves have different shapes, especially at low range fractions, the apparent range must be plotted against range fraction and must be extrapolated to zero count to get a reliable range. Then Glendenin's range-energy equations give E_{max}. The Bleuler-Zunti method requires determination from the absorption curve of absorber thicknesses d_n required to reduce count by 2^n ($n = 1, 2, 3\ldots$). Bleuler and Zunti have provided graphs that give E_{max} as a function of each of the d_n's. Accuracy improves at higher values of n. The Harley-Halliden method uses a plot of the relative activity of the sample against the relative activity of a standard for the same absorber

thicknesses. The resulting slope indicates the unknown E_{max}, which can be determined from calibration curves given by Harley and Halliden. (L.T.W.)

2973

SHADOW AUTORADIOGRAPHY OF BETA-EMITTING PARTICLES. N. L. Dockum and R. Borasky (General Electric Co., Richland, Wash.). Nucleonics 15, No. 11, 110(1957) Nov.

2974

EFFECTIVE CADMIUM CUTOFF ENERGY. I. E. Dayton and W. G. Pettus (Babcock & Wilcox Co., Lynchburg, Va.). Nucleonics 15, No. 12, 86-8(1957) Dec.

Cadmium is commonly used in neutron transmission and activation experiments as an absorber for thermal neutrons. Its high thermal cross section(about 2,500 b) combined with an absorption resonance at 0.178 ev produces an excellent high-pass filter. The effective cutoff energy of cadmium filters is generally taken to be between 0.4 and 0.5 ev. More precise values are derived and presented graphically. (L.T.W.)

2975

ENERGY DETERMINATION OF ELECTROMAGNETIC CASCADES IN NUCLEAR EMULSIONS. K. Pinkau (Univ. of Bristol). Phil. Mag. (8) 2, 1389-92(1957) Nov.

A method is presented for obtaining sufficient information about the primary energy of a γ ray initiating a cascade shower merely by deterining the radial distribution of cascade electrons at given distances from the origin (taken as the point where the first pair converts in the cascade). (L.T.W.)

2976

ANGULAR CORRELATION OF POSITRON ANNIHILATION IN TEFLON. S. D. Warshaw (Hebrew Univ. of Jerusalem, Israel). Phys. Rev. 108, 713-15(1957) Nov. 1.

The angular correlation of the 2-quantum decay of positrons annihilating in a Teflon absorber has been measured at room temperature and at 490°K, in each case with a magnetic field of 10 kilogauss and in the absence of the field. The results are consistent with prediction based on the assumption of conversion between triplet and singlet states of positronium. (auth)

2977

NORMAL VIBRATIONS OF GERMANIUM BY NEUTRON SPECTROMETRY. B. N. Brockhouse and P. K. Iyengar (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Phys. Rev. 108, 894-5(1957) Nov. 1.

2978

ANGULAR CORRELATION OF ANNIHILATION RADIATION IN VARIOUS SUBSTANCES. G. Lang and S. DeBenedetti (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 108, 914-21(1957) Nov. 15.

The angular correlations of gamma-ray pairs arising from positron annihilation in various solids have been observed. With good resolution, measurements of these angular distributions have been made for a wide variety of metallic elements, several ionic salts, several insulators, and a semiconductor. Some of the results from metals are accountable in terms of the Fermi-gas model of conduction electrons and the assumption of thermalized positrons. Many metals exhibit angular distributions which differ significantly from the Fermi-gas type, while retaining some of its features. For the noble and transition metals, however, the simple treatment is completely inadequate. Some possible theoretical interpretations of these distributions will be indicated. Measurements made on a group of alkali halides indicate the dominance of the halogen in determining the angular distribution, the width of which increases regularly with the chemical activity. The possibility of using positrons to study Pd–H alloys has been investigated. A measurement of positron mobility in diamond yielded a null result, within the accuracy of the experiment. (auth)

2979

MECHANISM FOR PRODUCTION OF X-RAYS BY ION CLOUDS STRIKING THE EARTH. Paul J. Kellogg (Univ. of Minnesota, Minneapolis and Naval Research Lab., Washington). Phys. Rev. 108, 1093-4(1957) Nov. 15.

2980

DETECTION OF Ga^{66} POSITRON POLARIZATION BY THE ANNIHILATION-IN-FLIGHT RATE IN POLARIZED MATTER. S. Frankel, P. G. Hansen, O. Nathan, and G. M. Temmer (Univ. of Copenhagen, Denmark). Phys. Rev. 108, 1099-1101(1957) Nov. 15.

2981

INELASTIC HEAVY PARTICLE COLLISIONS INVOLVING THE CROSSING OF POTENTIAL ENERGY CURVES. V. CHARGE TRANSFER FROM NEUTRAL ATOMS TO DOUBLY AND TRIPLY CHARGED IONS. T. J. M. Boyd and B. L. Moiseiwitsch (Queen's Univ. of Belfast). Proc. Phys. Soc. (London) A70, 809-14(1957) Nov.

The Landau-Zener formula for the transition probability arising from the pseudo-crossing of potential energy curves is used to investigate charge transfer processes of the type $A + B^{3+} \rightarrow A^{+} + B^{2+}$ involving neutral helium atoms and triply charged ions of Be, Li, Al and Mg. In addition, a method based on the Landau-Zener formula involving one experimentally determined parameter is used to calculate cross sections for processes of the type $A + B^{2+} \rightarrow A^{+} + B^{+}$. Good agreement is found with the cross sections obtained in the laboratory by Hasted and Smith for N^{2+} ions in He and Ne, and for Ar^{2+} ions in Ne. (auth)

2982

METHOD FOR DETERMINING THERMAL CONDUCTIVITY AT HIGH TEMPERATURES. C. L. Longmire (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 28, 904-6 (1957) Nov.

A method has been developed for determining thermal conductivity by measuring temperatures at the center of the faces of a rectangular rod which is heated electrically. Radiation of energy causes a difference in the temperatures of the short and long faces, and this difference is related to the thermal conductivity. The emissivity of the surface must be known. The method has been applied successfully by Dr. Ralph Muller, of the Los Alamos Scientific Laboratory, to the measurement of the thermal conductivity of graphite at temperatures near 2500°K, when other standard methods failed. (auth)

2983

PRODUCTION AND USE OF HIGH TRANSIENT MAGNETIC FIELDS. H. P. Furth (Univ. of California, Livermore); M. A. Levine (Air Force Cambridge Research Center, Bedford, Mass.); and R. W. Waniek (Harvard Univ. and Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 28, 949-58(1957) Nov.

The transient containment of high magnetic energy densities in coils of various geometries is discussed. Inherent mechanical and thermal limitations are shown to apply to coils relying solely on the strength of materials. The usefulness of inertial effects is demonstrated. Instrumentation is described for producing 10 μsec range pulses of amplitude up to 1.6 megagauss in single-turn coils. Experimental observations document the appearance of "saw effect" and Kruskal-Schwarzschild instabilities at very high fields. The limitations characteristic of conventional coils can be overcome in force-free geometries. The appropriate mathematics is developed and illustrated with practical examples. (auth)

Cosmic Radiation

2984
NUCLEAR INTERACTIONS IN NUCLEON-PROTON AND NUCLEON-CARBON NUCLEUS COLLISIONS ABOVE 10 GeV. Koichi Suga (Univ. of Tokyo, Japan). J. Phys. Soc. Japan 12, 1171-7(1957) Nov.

Nuclear interactions in hydrogen and carbon by nucleon (a few to several tens of Bev) have been studied using a multiplate cloud chamber which contained paraffin, carbon, and lead at mountain altitude. The cross section for the nuclear interaction by nucleon-proton collision was found to be 60 ± 17 mb, assuming the cross section for nucleon-carbon nucleus 320 mb. Energy spectra of neutral pions produced in paraffin, graphite, and lead were compared. The energy distribution of neutral pions in paraffin-interactions is more steep in low energy region and similar in high energy region compared with that in carbon-interactions, and possible interpretation are given. Charged secondary particles are emitted isotropically in cm system in nucleon-nucleon collision, and in the carbon nucleus some secondary particles undergo secondary collisions in the same nucleus. The azimuthal angle distribution of secondary particles was examined and some comments are mentioned. (auth)

2985
COMPARISON OF COSMIC-RAY INTENSITY VARIATIONS OBSERVED AT DIFFERENT ALTITUDES. Yukio Miyazaki. J. Sci. Research Inst. (Tokyo) 51, 97-106(1957) Sept.

Simultaneous registrations of the cosmic-ray meson component have been made at sea level and at mountain altitude of almost the same geomagnetic latitudes and longitudes. The time variation of comparatively low energy side of the primary cosmic radiation could be derived by the comparison of the intensity variations observed at different altitudes. (auth)

2986
CUT-OFF RIGIDITIES OF COSMIC-RAY PARTICLES CALCULATED FOR THE ECCENTRIC DIPOLE MODEL OF THE EARTH'S MAGNETIC FIELD. Masahiro Kodama, Ichirō Kondō, and Masami Wada. J. Sci. Research Inst. (Tokyo) 51, 138-57(1957) Sept.

Magnetic cut-off rigidities of cosmic-ray particles falling from zenith are calculated for the eccentric dipole model of the earth's magnetic field. The difference between the distances of the point of observation from the magnetic and geographic centers, actual magnetic latitude, and the angle between verticals referred to the two centers are considered as the quantities for correcting the rigidities calculated for the centered dipole field. Tables of numerical results together with contour maps are presented for the points along the geographic latitudes from 70° north to 70° south in 10° intervals, with the longitude intervals of 15°. Comparisons of results of similar calculations by several workers are performed. It is shown that rigidities derived from Johnson's map are greater than the present results up to 3 BV in the middle latitudes. (auth)

2987
LARGE AURORAL EFFECT ON COSMIC-RAY DETECTORS OBSERVED AT 8 g/cm^2 ATMOSPHERIC DEPTH. J. R. Winckler and L. Peterson (Univ. of Minnesota, Minneapolis). Phys. Rev. 108, 903-4(1957) Nov. 1.

2988
RARE HIGH-ENERGY PHOTON JET IN COSMIC RAYS. O. B. Young and T. S. Yoon (Southern Illinois Univ., Carbondale). Phys. Rev. 108, 908-9(1957) Nov. 1.

2989
MEASUREMENTS ON EXTENSIVE AIR SHOWERS AT MOUNTAIN ALTITUDES AT THE GEOMAGNETIC EQUATOR. B. Jongejans and F. Schurink. Physica 23, 977-86 (1957) Oct.

Counter measurements on extensive air showers were performed at an atmospheric depth of 600 g cm^{-2} and 700 g cm^{-2} in the Peruvian Andes, corresponding to respectively 4540 and 3250 meter altitude. Three and sixfold coincidences obtained from counter arrays with different sensitive area were compared. The coefficient g of the inverse power law differential spectrum relating the relative occurrence of a shower to its density was determined. A deviation from the generally accepted theory is found, the constant g varying from 2.27 ± 0.04 to 2.48 ± 0.03 depending on its method of determination. The extension of the setup used for obtaining these values of g varied from 1.6 to 3 m. Results obtained with a different setup (distances up to 100 m) are also given, g increasing from 2.5 ± 0.1 to 3.2 ± 0.2 when the extension of the setup was increased from 5 to 98 m. The absorption lengths obtained from these experiments show a decrease from 138 ± 5 g cm^{-2} to 45 ± 3 g cm^{-2} with increasing shower size. (auth)

2990
ON THE ANGULAR DISTRIBUTION OF PENETRATING COSMIC-RAY PARTICLES AT A DEPTH 103 MWE BELOW GROUND. B. V. Sreekantan, S. Naranan, and P. V. Ramanamurty (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. A43, 113-29(1956).

The production spectrum of the parents of the underground penetrating particles was determined from a measurement of the angular distribution of the penetrating particles at a depth of 103 mwe. The results indicate a power-law production spectrum with an exponent −1.92 ± 0.08. This production spectrum was used to deduce the theoretical intensity-depth curves for different compositions of the parents of μ mesons. A comparison of the theoretical curves with the composite intensity-depth curve leads to the following conclusions: (a) The experimentally determined intensity-depth curve can not be quantitatively explained if π mesons produced in the nuclear interactions of the primaries are the only parents of μ mesons and if they have the properties that the production spectrum is a power law with an exponent greater than 1.8, π mesons decay into μ mesons with a life time 2.56×10^{-8} sec, and π mesons interact with the same cross section as the primaries. (b) The production, in addition to π's of other heavy mesons which decay into μ mesons, will not remove the discrepancy between the observed and theoretical intensity-depth curves, unless these heavy mesons are produced in as large numbers as the π's and have a lifetime for μ decay less than 10^{-9} sec. Existing experimental evidence indicates a ratio not smaller than 3 for the ratio of production of π's to heavy mesons and a lifetime of the order of 10^{-8} secs for the decay of heavy mesons into μ mesons. Calculation shows that the discrepancy of the mesons produced in nuclear interactions are μ mesons or short-lived particles decaying into μ mesons. At present there is no experimental evidence either in favor of or against such a hypothesis. (auth)

2991
NUCLEAR DISINTEGRATIONS PRODUCED IN NUCLEAR EMULSIONS BY α-PARTICLES OF GREAT ENERGY. M. V. K. Appa Rao, R. R. Daniel, and K. A. Neelakantan (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. A43, 181-201(1956).

A study of nuclear disintegrations caused by α particles of primary cosmic radiation with energies > 5 Bev per nucleon has been carried out. In a systematic survey in

nuclear emulsions using "along the track" scanning method, 479 α particles with a total track length of 40.84 meters and 242 interactions were obtained. From the angular distribution of shower particles associated with these interactions, a procedure has been found for distinguishing protons, which originally formed part of the incident α particle and which have not taken part in the interaction, from other charged particles. The mean free path for nuclear interaction in G-5 emulsion is found to be 17.5 ± 1.1 cm (68.9 ± 4.3 gm/cm^2). Assigning both to the incident α particle and to the target nuclei a radius $R = r_0 A^{1/3}$, one obtains an effective nuclear radius $r_0 = 1.13 \pm 0.04 \times 10^{-13}$ cm. Using the number of protons emerging from disintegrations of heavy nuclei (Silver and Bromine) without having participated in the interaction (as can be deduced from the angular distribution) and assuming spherical nuclei of uniform density, the mean free path of nucleons in nuclear matter is calculated to be less than 3.2×10^{-13} cm. (auth)

2992

THE IONIZATION SPECTRUM OF COSMIC RAYS 3250 m ABOVE SEA LEVEL. A. G. Meshkovskii and L. I. Sokolov. Soviet Phys. JETP 4, 629-32(1957) June.

Using a previously described method, the ionization spectra produced by the soft and hard components of cosmic rays of various ranges at 3250 m above sea level were measured. The proton momentum spectrum was obtained in the interval 0.36 to 1.0 bev/c. (auth)

2993

A COMPARISON OF THE FERMI-LANDAU THEORY WITH SOME EXPERIMENTAL DATA ON COSMIC RAYS. O. A. Guzhavina, V. V. Gizhavin, and G. T. Zatsepin (Academy of Sciences, USSR). Soviet Phys. JETP 4, 690-700(1957) June.

The energy spectra of the secondary particles originating in nuclear collisions of high-energy particles (10^{12} to 10^{18} ev) have been calculated on the basis of the theory of L. D. Landau. A calculation of the altitude dependence of the radioactive particles in the atmosphere, as well as of the number of high-energy μ mesons at sea level, has been carried out on the basis of the spectra obtained. The results of the calculations are compared with experimental data. (auth)

2994

DECAY OF A τ'-MESON. V. V. Alpers, and A. P. Mishakova. Soviet Phys. JETP 4, 768-9(1957) June.

Examination of a photographic emulsion exposed in the stratosphere in May 1955 revealed a particle decaying into a single positive pion which exhibited a typical picture of $\pi \rightarrow \mu \rightarrow e^-$ decay. The range of the μ meson is 550μ. The track of the primary particle was inclined at a large angle to the emulsion and that of the secondary particle (the pion) was parallel to the emulsion. This complicates an interpretation of the event which might still be considered as the scattering of a pion. Measurements were made on the grain density of several pion tracks inclined at the same angle and going in the same direction as the primary particle. Comparison of the grain densities of these tracks with the density of the track under consideration indicated that the scattering of a pion is definitely excluded. This must therefore be a particle decay event. The path of the pion measured 600μ and its energy was determined to be 4.6 Mev; this excludes the decay of a K particle according to the scheme $K \rightarrow \pi + n^\circ + Q$. The event was therefore interpreted as the decay of a τ meson. (A.C.)

2995

THE EFFECT OF COSMIC RADIATION ON IRON METEORITES. K. H. Ebert and H. Wänke. Z. Naturforsch. 12a, 766-73(1957) Oct. (In German)

2996

CLOUD CHAMBER INVESTIGATION OF THE ELECTRON-PHOTON COMPONENT OF EXTENSIVE AIR SHOWERS AT SEA LEVEL. I. A. Ivanovskaya, G. V. Kulikov, I. V. Rakobolskaya, and L. I. Saritcheva (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 358-64(1957) Aug. (In Russian)

A significant discrepancy was found to exist between the fraction of high energy electrons observed experimentally and that computed from cascade theory for various distances from the shower axis. The spatial distribution of the energy carried by the electron-photon component can be approximated by the law r^{-n} where $n = 2 \pm 0.5$ for shower distances from 2 to 10 meters. (tr-auth)

2997

ON THE PROTON COMPONENT IN COSMIC RADIATION AT THE SEA LEVEL. A. G. Meshkovskiĭ and L. I. Sokolov. Zhur. Eksptl'. i Teoret. Fiz. 33, 542-3(1957) Aug. (In Russian)

The position of the maximum spectra of the soft cosmic radiation component and the total intensity of the vertical proton flux at sea level were studied. The table of proton pulses at 0.31 to 0.55 Bev/c is given. The maximum of proton spectra at sea level was found in the pulse range 0.5 to 0.6 Bev/c, and it coincided with the proton spectra maximum taken at 3250 m above sea level. Both spectra are similar in shape as should have been expected, since both spectra are spectra of secondary particles. (R.V.J.)

2998

INVESTIGATION OF NUCLEAR DISINTEGRATIONS PRODUCED BY THE CHARGED COMPONENT OF COSMIC RADIATION. T. L. Asatiani and G. V. Khrimian (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 561-6(1957) Sept. (In Russian)

The momentum spectrum of negative π mesons from stars created by charged cosmic rays of ~30 Bev energy has been obtained. The power exponent of the spectrum is $\gamma = 1.46 \pm 0.2$. The ratio of positive to negative π mesons $N_{\pi^+}/N_{\pi^-} = 1.67 \pm \frac{0.61}{0.55}$ and the number of protons relative to the number of particles possessing a momentum $\rho \geq 10^9$ev/c is ~30%. (tr-auth)

2999

SOLUTION OF KINETIC EQUATIONS FOR HIGH ENERGY NUCLEAR-CASCADE PROCESSES. N. M. Gerasimova (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 637-44(1957) Sept. (In Russian)

The altitude dependence of high energy nuclear active particles and the spectrum of μ mesons produced in the decay of π mesons are investigated. The elementary act is described hydrodynamically; Landau's function, in which account is made of a travelling wave in the hydrodynamic solution, is taken as the energy distribution function of the produced particles. (tr-auth)

3000

ON THE GREEN'S FUNCTION OF THE CASCADE KINETIC EQUATIONS. Kh. J. Khristov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 683-95(1957) Sept. (In Russian)

A cascade is considered which consists of several types of particles moving in a nonuniform and variable medium; these particles collide with the particles of the medium and are scattered and absorbed and produce new cascade particles. Functions are introduced which specify the spatial and velocity distribution of each type of particle at any moment of time. Integral equations for these functions are given. Approximate solutions of these equations are

presented which are valid at large values of time and refer to a uniform and time independent medium. Better solutions are obtained by iteration. (tr-auth)

3001
ON THE FUNCTION OF THE ANGULAR DISTRIBUTION OF PARTICLES IN THE MAXIMUM OF THE CASCADE SHOWER. I. P. Ivanenko (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 825-7(1957) Sept. (In Russian)

Crystallography and Crystal Structure

3002 NP-6490
Battelle Memorial Inst., Columbus, Ohio.
NEUTRON DOSIMETRY RESEARCH. Quarterly Progress Report No. 2 for Period June 15, 1957 to Sept. 14, 1957. W. S. Diethorn, E. Paskell, R. K. Willardson, J. W. Moody, R. Beck, G. LaMale, and J. McFarling. Oct. 2, 1957. 36p. Contract DA-36-039-SC-73174.

The examination of important semiconductor literature was continued and the theoretical analysis of lifetime phenomena in Si and Ge extended. Experimental work was initiated to determine the relationship between neutron dose and lifetime changes in these materials. Preliminary experiments were completed on single crystals of AlSb, CdTe, and InP, as part of the study to determine the application of these high-energy-gap compound semiconductors to neutron dosimetry based on conductivity changes. Although the specimens used in these latter experiments were not optimum, the experimental results indicate that these materials have promise for the Signal Corps dosimeter application. The paper study of ionization-chamber theory and performance is under way. Activities in this area were concentrated on the literature aspects of this subject. The major effort in the initial stage of this study will be an analysis of ion recombination and the effect of this phenomenon on ionization-chamber performance. Some effort during this quarter was devoted to a search for new approaches to neutron dosimetry. A paper study is being made on several candidate systems. (For preceding period see NP-6433.) (auth)

3003
THE STRUCTURE OF THE δ PHASE IN THE URANIUM–ZIRCONIUM SYSTEM. E. R. Boyko (Knolls Atomic Power Lab., Schenectady, N. Y.). Acta Cryst. 10, 712-13(1957) Nov.

The δ phase of the U–Zr alloy was found to be primitive hexagonal with c = 3.08 and a = 5.03 A and with a composition UZr_2. (W.L.H.)

3004
A CONTOUR GENERATOR FOR X-RAY CRYSTAL STRUCTURE ANALYSIS. S. Krishnan (Indian Inst. of Science, Bangalore). J. Sci. Ind. Research (India) 16B, 432-5(1957) Oct.

An electronic device has been developed for the presentation of a two-dimensional function as a contour map on the screen of a cathode ray oscillograph, to be used in conjunction with an analog computer for x-ray crystal structure analysis. The function to be plotted is fed as an electrical voltage to one pair of plates of cathode ray tube in front of which a system of slits and a photomultiplier are placed. The pulse output from the photomultiplier intensifies the spot on a second oscillograph whose x and y time bases are properly synchronized with the scanning of the function. The image photographed from the second cathode ray tube is the contour map. (auth)

3005
ANNEALING OF ELECTRON BOMBARDMENT DAMAGE IN SILICON CRYSTALS. G. Bemski and W. M. Augustyniak (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 108, 645-8(1957) Nov. 1.

Silicon crystals were bombarded at room temperature with electrons of 700 kev from a Van de Graaff accelerator. The annealing of the bombardment damage was studied between 200 and 400°C by observing the recovery of the minority-carrier lifetime. The annealing was found to proceed with an activation energy of 1.3 ev. This is interpreted as being the activation energy associated with the lattice jump frequency. The kinetics of the annealing are identical in most p-type and n-type crystals. A second-order process has been identified toward the end of the annealing. Evidence is given that crystalline defects can influence the annealing kinetics. (auth)

3006
DETECTION OF OPTICAL LATTICE VIBRATIONS IN Ge AND ZrH BY SCATTERING OF COLD NEUTRONS. I. Pelah, C. M. Eisenhauer, D. J. Hughes, and H. Palevsky (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 1091-2(1957) Nov. 15.

3007
NEUTRON INVESTIGATION OF OPTICAL VIBRATION LEVELS IN ZIRCONIUM HYDRIDE. A. Andresen, A. W. McReynolds, M. Nelkin, M. Rosenbluth, and W. Whittemore (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 108, 1092-3(1957) Nov. 15.

3008
THERMAL RESISTANCE DUE TO ISOTOPIC MASS VARIATION. P. G. Klemens (Commonwealth Scientific and Industrial Research Organization, Sydney). Proc. Phys. Soc. (London) A70, 833-6(1957) Nov.

It was pointed out previously that the mass variation due to the isotopic constitution of a solid can lead to a scattering of lattice waves which, in sufficiently pure dielectric solids, may contribute significantly to the thermal resistance at low temperatures. The work done along this line and discrepancies encountered are discussed. (M.H.R.)

3009
CRYSTAL STRUCTURE OF AgO. J. A. McMillan. Publs. com. nacl. energia atomica (Buenos Aires) Ser. fis. 1, No. 4, 83-91(1954). (In Spanish)

Electrical Discharge

3010
ON THE BEHAVIOR OF A COMPLETELY IONIZED PLASMA IN A STRONG MAGNETIC FIELD. S. I. Braginskiĭ (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 645-54(1957) Sept. (In Russian)

Some paradoxes arising during applications of transfer equations in investigations of quasistationary completely ionized plasma were considered for the case when collision frequency between the particles is much smaller than their rotation frequency in a magnetic field. The cylindrical plasma pinch in which the plasma pressure is balanced by electrodynamical forces of the stream in the pinch was investigated. Some solutions of plasma equations were found for the stationary and nonstationary states. (tr-auth)

3011
ON THE SCATTERING OF ELECTROMAGNETIC WAVES IN A PLASMA. A. I. Akhiezer, I. G. Prokhoda, and A. G. Sitenko (Khar'kov State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 750-7(1957) Sept. (In Russian)

Combinational scattering on plasma density oscillations may occur when electromagnetic waves are propagated in a plasma. The intensity of combinational scattering of

electromagnetic waves in a plasma is determined in the absence and in the presence of a constant uniform magnetic field. (tr-auth)

3012

A SYMPOSIUM [ON] MAGNETOHYDRODYNAMICS. Rolf K. M. Landshoff, ed. Stanford, Stanford University Press, 1957. 122p.

The different physical conditions under which an ionized gas in a magnetic field will react in a manner that is dominated by one or another physical phenomenon are outlined. Treatments of mechanisms for explaining the magnetic field of the earth and of certain stars and nebulae are included. Theoretical predictions are made on the effects to be expected when a shock wave passes a conducting region of varying magnetic flux density, with possible applications ranging from astrophysical phenomena to practical laboratory experiments. In a discussion of the pinch effect new features are introduced by the near absence of collisions as a factor in establishing thermodynamic equilibrium. An introduction on the use of scaling laws, showing how experiments made under widely different conditions can be compared, is followed by descriptions of laboratory experiments on the passage of shock waves through magnetic fields, magnetically driven shock waves, Kruskal-Schwarzchild-type instabilities, and standing magnetohydrodynamic waves. (M.H.R.)

Electrons

3013 UCRL-4942

California. Univ., Livermore. Radiation Lab.

RADIATION DAMPING OF AN ELECTRON IN A UNIFORM MAGNETIC FIELD. Gordon Gibson and Eugene J. Lauer. July 23, 1957. 11p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

A pair of differential equations were obtained which express the time rate of change of the angle between the momentum vector and the magnetic field vector, and the time rate of change of the energy of the electron. The analytic solutions are given. (auth)

3014

A POSSIBLE DISSYMMETRY BETWEEN THE ELECTRON AND THE POSITRON. Bernard Jouvet. Compt. rend. 245, 1397-8(1957) Oct. 21. (In French)

The customary methods of quantification of the fields of fermions imply a group of postulates which cannot all be requisite. The case where the symmetry of the charge is neglected in quantification was studied. The positrons could then obey the statistics of Bose, contrary to electrons; a measurable effect is indicated. (tr-auth)

3015

PRODUCTION OF ELECTRON PAIRS BY 550-Mev ELECTRONS. F. J. Loeffler (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 1058-62(1957) Nov. 15.

The mean free path of high-energy electrons for direct electron pair production has been measured in Ilford G-5 nuclear emulsions. Electrons were produced by directing the 850-Mev bremsstrahlung beam from the Cornell synchrotron upon a Pb target and analyzing the negative members of the resultant electron pairs in a magnetic momentum analyzer. Electrons in the range 400 to 800 Mev were intercepted by glass-mounted emulsions 400 μ thick and, after processing, the resultant tracks were followed a distance of 1 cm in a search for electron pairs. Separation of bremsstrahlung-produced pairs from the real tridents was achieved by measuring the spatial distribution of the former about the primary tracks. This distribution, after being corrected for scanning efficiency and fitted with the theoretical distribution of Koshiba and Kaplon, indicated that for the conditions of this experiment 72% of the events classified initially as tridents were in reality bremsstrahlung pairs. The mean free path for the direct pair production process was found to be 143 ± 47 cm for a primary electron energy of 536 ± 94 Mev. The theoretical prediction of Racah for this energy is 148 cm and is in good agreement with this experiment. (auth)

3016

AN INTERNAL CONVERSION COEFFICIENT FOR THE OUTERMOST ELECTRON SHELL IN XENON. A. E. S. Green (Florida State Univ., Tallahassee) and A. H. Snell (Oak Ridge National Lab., Tenn.) Proc. Roy. Soc. (London) A242, 400-2(1957) Nov. 5.

The observed intensity of the singly charged ions in the charge spectrum produced by the isomeric decay of 12-day Xe^{131} is used in conjunction with a theoretical estimate of the radiation probability of the (5p−1s) x-ray transition in the K series of Xe, to yield a value for the internal conversion coefficient of the 163 kev γ ray in the 5p shell. The value so obtained is 0.21 ± 0.03. (auth)

3017

ELECTRON IMPACT PHENOMENA AND THE PROPERTIES OF GASEOUS IONS. F. H. Field and J. L. Franklin. New York, Academic Press Inc., 1957. 358p.

A compilation and review of electron impact phenomena in gases at low pressure involving low-energy electrons and resulting in ion formation, and the properties of gaseous ions is given, with emphasis on the chemical physics of the systems studied. Discussions are included on apparatus and methods, theory, energy considerations, mass spectral considerations, and implications for chemical reactions. A compilation of critical potential values is given in an appendix. (M.H.R.)

Gases

3018

DIFFUSION COEFFICIENTS OF THE SYSTEMS Xe−Xe AND A−Xe. I. Amdur and T. F. Schatzki (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 27, 1049-54 (1957) Nov.

The diffusion of radioargon, Ar^{37}, and of radioxenon, Xe^{131m}, through inert xenon was measured at −78, 0, 57, and 105°C. The apparatus, a Loschmidt cell in which saturation ionization currents were used as a measure of tracer concentrations, yielded diffusion coefficients which are estimated to have an accuracy of about one percent. The intermolecular potentials of Xe−Xe, derived from the present results, agree with those obtained from thermal conductivity data in the same temperature range, but do not agree with potentials derived from second virial coefficients and crystal data. Nor do they agree with potentials derived from viscosity and thermal conductivity data at higher temperatures. It is shown that this lack of agreement is due to the inadequacy of the potential form. The potential well for the rare gases should be narrower than that given by the Lennard-Jones 12-6 potential. (auth)

3019

OSCILLATIONS IN PLASMA. I. Shoji Kojima, Kiyoe Kato, and Shigeo Hagiwara (Tokyo Univ. of Education, Japan). J. Phys. Soc. Japan 12, 1276-81(1957) Nov.

By using a super-regenerative detector, plasma oscillations have been studied. On similar discharge tubes to Looney-Brown's tube many plasma oscillations were observed without auxiliary electron beams. When a small beam was introduced into main plasma, all the oscillations became stronger but their frequencies remain unchanged.

For the excitation of plasma oscillations the existence of thick ion sheaths was not necessary. With usual discharge tubes plasma oscillations were detected from the outside of tubes by a small antenna. Many plasma oscillations having slight different frequencies were always observed. However, details of these oscillations are still obscure. (auth)

3020
ROLE OF METASTABLE STATES IN THE PRODUCTION OF SCINTILLATIONS IN THE RARE GASES BY ALPHA PARTICLES. P. Avivi and S. G. Cohen (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 108, 972-3(1957) Nov. 15.

The lifetimes of alpha-ray induced scintillations in the rare gases (Xe, Kr, Ar, and Ne) were measured as a function of pressure. The lifetimes were found to be inversely proportional to the pressure. It is shown that the major part of the scintillations are in the far ultraviolet—below 1250 A. It is suggested that these scintillations result from the destruction of metastable excited states of the rare gas ions. (auth)

Instruments

3021 AERE-E/S-24
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DEVELOPMENT AND PRODUCTION OF A MOBILE BERYLLIUM MONITOR. T. W. Hodge. Sept. 1957. 12p.

A Ford van was reconditioned and modified. The front part of the van was sealed to include the monitor and operator's seats and a self-contained generator set was provided. (M.H.R.)

3022 KAPL-M-GLC-3
Knolls Atomic Power Lab., Schenectady, N. Y.
A SIMPLE DEVICE FOR MEASURING TORQUE AND TWIST IN A SLOWLY ROTATING SYSTEM. G. L. Cutler. Nov. 11, 1957. 8p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

A device was developed as a remote drive for the torsion tester to be used in the Radioactive Materials Laboratory. This device not only provides the rotating motion to the test but also incorporates scales for determining the torque applied to the specimen and the amount of twist. (auth)

3023 SCTM-220-57(51)
Sandia Corp., Albuquerque, N. Mex.
A SHOCK OR DETONATION ARRIVAL INDICATOR. W. B. Benedick. Aug. 2, 1957. 12p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

A simple dynamic device for determining the arrival of a shock or detonation wave is presented. The device develops 120 volts into a 50-ohm load. Consequently, the output of the device may be applied directly to the deflection plates of a Tektronix 517 oscilloscope without amplification, and the signals may be mixed without electronic circuitry. With a sweep speed of 10 m μsec per cm of trace, time resolution of the order of 10^{-9} seconds can be attained. (auth)

3024 AEC-tr-3092
A RADIO ELECTRIC ALTIMETER WITH FREQUENCY MODULATION. (Un Altimètre Radioélectrique a Modulation de Fréquence). G. Collette and R. Labrousse. Translated by M. I. Weinreich from Ann. Radioélectr. 10, 387-98(1955). 25p.

3025
AN AUTOMATIC PROGRAMMING FILTER SAMPLER. Gilbert S. Raynor (Brookhaven National Lab., Upton, N. Y.). J. Air Pollution Control Assoc. 7, 122-4(1957) Aug.

A design is presented for an automatic air sampling device. The device will take discrete samples periodically and can be constructed easily with stock parts. (W.L.H.)

3026
A CHRONOGRAPH FOR RECORDING VARIABLE COUNTING RATES. I. Kuščer and M. V. Mihailović. "J. Stefan" Inst. Repts. (Ljubljana) 2, 51-2(1955) May.

Variable counting rates can be measured by recording the output signals of a scaler upon paper tape. A chronograph intended for this purpose is described. (auth)

3027
D-C MAGNETIC FLOWMETER FOR LIQUID SODIUM LOOPS. C. G. Pfister and R. J. Dunham (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 15, No. 10, 122-4(1957) Oct.

3028
HIGH-REPETITION-RATE MERCURY PULSER. L. Costrell (National Bureau of Standards, Washington). Nucleonics 15, No. 11, 112(1957) Nov.

Mercury-relay-type pulsers are widely used for the generation of rapidly rising exponentially decaying pulses. The design of a high-repetition-rate mercury pulser is described. (L.T.W.)

3029
HIGH-TEMPERATURE MOLECULAR BEAM MICROWAVE SPECTROMETER. Allen K. Garrison and Walter Gordy (Duke Univ., Durham, N. C.). Phys. Rev. 108, 899-901 (1957) Nov. 1.

3030
IMPROVED ULTRAVIOLET MICROBEAM APPARATUS. Robert B. Uretz and Robert P. Perry (Univ. of Chicago, Ill.). Rev. Sci. Instr. 28, 861-6(1957) Nov.

An ultraviolet microbeam apparatus utilizing the principle of incident illumination has been developed for the irradiation of small parts of living cells or other microscopic objects. A reflecting microscope objective is used simultaneously in a visible light viewing-aiming system and in a bombardment system to focus a spot of ultraviolet light (as small as one micron in diameter) onto part of an experimental preparation. Provision is made in the apparatus for auxiliary phase contrast viewing and for monitoring of the energy in the microbeam. Details of construction and alignment are given and the distribution of intensities in the microbeam is discussed. (auth)

3031
CRYOGENIC ELECTROMAGNETS. I. FEASIBILITY STUDY. Henry L. Laquer and Edward F. Hammel (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 28, 875-8(1957) Nov.

Electromagnets have been built for continuous operation in liquid hydrogen. A steady field of 62,000 oersted, corresponding to a power dissipation of 15 kw, has been obtained in freely boiling hydrogen with a coil 5 in. long, 2.5 in. internal diameter, and 7.5 in. external diameter. Some of the mechanical, electrical, heat transfer, economical, and safety problems encountered in this work are discussed. (auth)

3032
SINGLE CRYSTAL GONIOMETER FOR X-RAY AND NEUTRON DIFFRACTION. G. E. B. Barstad (Norwegian Defense Research Establishment, Kjeller) and A. F. Andresen (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Rev. Sci. Instr. 28, 916-18 (1957) Nov.

A single crystal goniometer intended both for x-ray and neutron diffraction analysis has been used in neutron diffraction work at the Kjeller reactor. The unique feature of this goniometer is a macromodel of the unit cell designed

for easy orienting of the crystal. A special arrangement is provided for setting any plane in reflecting position without previously calculating the angles and a set of three-dimensional data can be recorded on a counter moving in the horizontal plane. (auth)

3033

SAMPLING OSCILLOSCOPE FOR STATISTICALLY VARYING PULSES. Robert Sugarman (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 28, 933-8(1957) Nov.

A sampling oscilloscope is described with a 10 to 90% rise time of 5.6×10^{-10} sec. Maximum useful sweep speed is about 10^{-10} sec/in.; maximum useful sensitivity about 15 mv/in. These are limited solely by the peak time jitter of 2×10^{-11} sec, and apparent input peak noise of about 300 μv. Unlike prior sampling devices, pulses of constant or random repetition rate are displayed with equal facility. The usual time jitter associated with the display of random pulse heights is eliminated by selecting for display only those pulses that fall within a kicksorter channel. The average wave form of pulses with moderately irregular shapes is particularly easy to measure. (auth)

3034

OPTICAL AND ELECTRON MICROSCOPE EXAMINATION OF PRESELECTED AREAS. T. K. Bierlein and B. Mastel (General Electric Co., Richland, Wash.). Rev. Sci. Instr. 28, 960-1(1957) Nov.

Since many reactor materials undergo changes in properties as a result of reactor irradiation, a study of microstructural changes in a material as a function of irradiation is a logical and relatively simple way of obtaining fundamental information on the effects of irradiation. Because of the fact that most materials become highly radioactive as a result of reactor irradiation, conventional metallographic procedures can not be used. The note describes a technique which facilitates optical and electron microscopy of both radioactive and nonradioactive materials. Identical areas are examined before and after treatment. Preparation of surface prior to irradiation is discussed. (A.C.)

Isotopes

3035

CARRIER-FREE SOLUTION STORAGE IN GLASS. I. L. Preiss and R. W. Fink (Univ. of Arkansas, Fayetteville). Nucleonics 15, No. 10, 108(1957) Oct.

Solutions of carrier-free radioactive nuclides in laboratories often are stored in glass containers. It is pointed out that carrier-free solutions always should be stored in inert plastic containers. Moreover, the introduction of extraneous solids from reagents such as HCl that have been stored in glass must be avoided, usually by repurification of all reagents. (L.T.W.)

3036

THE PHASE SEPARATION OF ^{3}He–^{4}He MIXTURES. D. H. N. Wansink. Physica 23, 922(1957) Oct.

3037

THE RADIOISOTOPES. George A. Papadatou. Athens, Greek Committee of Atomic Energy, 1956. 74p. (In Greek)

A general review is given of the preparation and separation of isotopes and the physical properties, measurements, radioactivity, and decay schemes. Biological effects and permissible levels of radiation as well as handling and protective measures are analyzed. Applications of radioisotopes for peaceful purposes, in medical science, agriculture, and industry, are discussed. (R.V.J.)

Isotope Separation

3038 AEC-tr-3096

THE ELECTRIC MASS FILTER. W. Paul and M. Raether. Translated from Z. Physik 140, 262-73(1955). 20p.

Mass Spectrography

3039

MASS SPECTROMETER WITH SECOND ORDER DOUBLE FOCUSING. H. Hintenberger and L. A. König. Z. Naturforsch. 12a, 773-85(1957) Oct. (In German)

Mathematics

3040 KAPL-1068

Knolls Atomic Power Lab., Schenectady, N. Y.

PREPARATION OF INPUT DATA FOR TWO-SPACE-DIMENSION MULTIGROUP. R. H. Stark. Oct. 26, 1954. Decl. Apr. 23, 1957. 32p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

This is an instruction manual which is intended to simplify the preparation of requests and inspection of data by the requestor and the interpretation of the request by the Calculating Unit. The only purpose for the writing is to define the meaning of symbols briefly explained in the glossary and to show how their values are assembled as UNIVAC input. The current codings available for numerical solution of two-space-dimension multigroup problems on the UNIVAC have code names MUG I and MUG II. MUG II is designed to include all properties of MUG I. The preparation of input for MUG II is described, as it has been planned whether the coding which uses that particular part of the input is checked out or not. (auth)

3041 SCTM-210-55(51)

Sandia Corp., Albuquerque, N. Mex.

ACCEPTANCE TESTING FOR INTERMITTENT DEFECTS ON A SAMPLING BASIS. C. R. Clark. Oct. 18, 1955. 13p. Contract [AT(29-1)-789]. $3.30(ph OTS); $2.40 (mf OTS).

A study of testing for intermittent defects on a one hundred per cent inspection basis has previously been made. This paper discusses the same testing on a sampling basis. (auth)

3042 SCTM-274-57(14)

Sandia Corp., Albuquerque, N. Mex.

AN IBM CARD-TO-PAPER TAPE CONVERTER FOR USE WITH THE LIBRASCOPE LGP-30 COMPUTER. H. B. Durham. Oct. 31, 1957. 10p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

The design of an IBM card-to-punched paper tape converter is described which converts data from IBM cards to a 1-2-4-8 four-level code on a tape which can be used in the Librascope LGP-30 digital computer. Principles employed in the design of the converter will help to solve other card-to-tape conversion problems. (auth)

3043 WAPD-T-567

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

P-CYCLIC MATRICES: A GENERALIZATION OF THE YOUNG-FRANKEL SUCCESSIVE OVERRELAXATION SCHEME. Richard S. Varga. Aug. 1957. 14p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The Young-Frankel successive overrelaxation scheme, which was shown to be applicable in the numerical solution of self-adjoint partial differential equations of elliptic type, is described. Successive overrelaxation is a theory

which depends on what Young calls (point) property (A). Both point and block property (A) can be interpreted via the works of Romanovsky and Frobenius on finite Markoff chains and stochastic matrices. It is shown that the fundamental lemma of the theory of successive overrelaxation follows as a corollary to a theorem by Romanovsky on cyclic matrices, which in turn leads to a generalization of both point and block property (A). It is also shown that the results previously obtained apply to the solution of Laplace's equation on a uniform triangular mesh. (M.H.R.)

3044 WAPD-T-650

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. IMPLICIT ALTERNATING DIRECTION METHODS. Garrett Birkhoff and Richard S. Varga. Oct. 1957. 20p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Variants of a new "implicit alternating direction method" have previously been shown to solve boundary value problems, for $-\nabla^2 u = S$ in a rectangle, much more rapidly than the Youn–Frankel "successive overrelaxation" method. Their applications to self-adjoint elliptic equations, of the form $\Sigma u - \nabla \cdot (D\nabla u) = S$, $\Sigma \geq 0$, $D > 0$ in a general plane region R, are considered. The special case of $\nabla^2 u = 0$ in a rectangle is typical for successive overrelaxation as applied to the general case, but results show that no similar conclusion is true for implicit alternating direction methods. The case of $-\nabla^2 u = S$ in a rectangle is essentially the only case to which the formulas are applicable. (M.H.R.)

3045 WAPD-TM-28(Add.)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. WANDA—A ONE-DIMENSIONAL FEW-GROUP DIFFUSION EQUATION CODE FOR THE IBM-704. Orville J. Marlowe and Ely M. Gelbard. Sept. 1957. 6p. Contract AT-11-1-GEN-14. $0.50(OTS).

The changes in WANDA-2 which are included in WANDA-3 are described. These involve (1) a change in the equations used, (2) a slight modification in the criticality search, (3) the possibility of doing one-iteration problems, (4) the addition of an off-line printing option, and (5) the use of a second core unit. Thus, the WANDA-3 code requires 8192 words of core storage, one drum unit, and one tape unit. Since the drum is used only to store converged flux values, a trivial modification can be made to use a tape unit in place of the drums. A listing of the symbolic decks may be obtained upon request. (auth)

3046 WAPD-TM-41

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ON ESTIMATING RATES OF CONVERGENCE IN MULTIGROUP DIFFUSION PROBLEMS. Richard S. Varga. Aug. 1957. 20p. Contract AT-11-1-GEN-14. $0.75 (OTS).

For many multigroup problems, the power method is very slowly convergent. One method for accelerating convergence is described. This technique requires the knowledge of what might be called the dominance ratio or homogeneous spectral norm, $\bar{\sigma}$, of the matrix T_0. A new theoretical method is given for estimating $\bar{\sigma}$ for multigroup diffusion problems. Examples are given to show that this method of obtaining $\bar{\sigma}$ compares favorably with standard methods. (M.H.R.)

3047 WAPD-TM-70

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PDQ—AN IBM-704 CODE TO SOLVE THE TWO-DIMENSIONAL FEW-GROUP NEUTRON-DIFFUSION EQUATIONS. G. G. Bilodeau, W. R. Cadwell, J. P. Dorsey, J. G. Fairey, and R. S. Varga. Aug. 1957. 66p. Contract AT-11-1-GEN-14. $1.75(OTS).

PDQ is a two-dimensional, reactor-design code for the IBM-704 computer; it finds a discrete numerical approximation to the few-group, time-independent, neutron-diffusion equations for a heterogeneous reactor in a two-dimensional rectangular region R with boundary Γ. The variables are either x-y, in rectangular coordinates, or r-z, in cylindrical coordinates. Denoting either set of coordinates by the vector $\vec{x}$, these neutron-diffusion equations are of the form:

$$\left\{-\nabla \cdot [D_i(\vec{x})\nabla\varphi_i(\vec{x})] + \sigma_i(\vec{x})\varphi_i(\vec{x}) = \frac{\chi_i\psi(\vec{x})}{\lambda} + \Sigma_{i-1}^{R}(\vec{x})\varphi_{i-1}(\vec{x})\right\}_{i=1}^{k}, \text{ where } \sigma_i(\vec{x}) = \Sigma_i^a(\vec{x}) + \Sigma_i^R(\vec{x}) + R_z^2 D_i(\vec{x}), \text{ and } \psi(\vec{x}) = \sum_{i=1}^{k} [\nu_i \Sigma_i^f(\vec{x})]\varphi_i(\vec{x}). \text{ (auth)}$$

3048

EXPLICIT SOLUTION OF THE HYDRODYNAMIC REPRESENTATION OF THE PAULI EQUATION FOR THE HYDROGEN ATOM. Pierre Hillion. Compt. rend. 245, 1516-18(1957) Oct. 28. (In French)

3049

PRELIMINARY RESULTS FROM A RECALCULATION OF THE MONTE CARLO EQUATION OF STATE OF HARD SPHERES. W. W. Wood and J. D. Jacobson (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 27, 1207-8 (1957) Nov.

3050

SYMPOSIUM ON ADVANCED PROGRAMMING METHODS FOR DIGITAL COMPUTERS, WASHINGTON, D. C., JUNE 28, 29, 1956. Washington, Office of Naval Research, [1956]. 88p. Available from OTS for $2.25.

Papers are presented on new definitions and developments since the last symposium, automatic coding principles, the development of common language automatic programming systems, the production of large computer programs, SHARE—a study in the reduction of redundant programming effort through the promotion of inter-installation communication, advanced programming techniques with smaller computers, computing at Los Alamos, group T-1, coding for the MANIAC, the proposed advanced coding system for UNIVAC-LARC, the RCA approach to automatic programming for commercial problems, the PACT compiler for the 701, the Automatic Digital Encoding System II, and a property of natural language and its use for the design of improved machine language (associative machine languages). (M.H.R.)

Measuring Instruments and Techniques

3051 AERE-EL/R-2326

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ANALYSIS OF LOW LEVEL GAMMA-RAY ACTIVITY BY SCINTILLATION SPECTROMETRY. P. Iredale and D. L. O. Humphreys. Aug. 1957. 11p.

A 3 × 3 in. sodium iodide crystal and multichannel pulse amplitude analyzer have been used to measure the activities of the gamma-ray emitters present in sources of low activity. The samples used to illustrate the application of the method were filter papers containing small amounts of nuclear explosion debris collected at high altitude for radiological investigations. It is shown that it is possible to measure the gamma-ray activity of several isotopes present in one sample when the activity of each is 10^{-11} curies or less. (auth)

3052 AERE-NP/R-2222
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A STUDY OF IONISATION DETECTORS FOR SUPER CHOPPER. J. F. Raffle. June 1956. Decl. Feb. 1957. 15p.

Design features for B ionization chamber and BF_3 proportional counter detectors for the twin rotor neutron spectrometer designed for use with DIDO are discussed. A plan is put forward for the construction of a proportional counter detector to offer a high degree of reliability but the constructional difficulties and the development work required make the proposals of little immediate practical value. (auth)

3053 AERE-R/M-137
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A SMALL FISSION CHAMBER. D. Barnes and R. Aves. Sept. 1957. 6p.

The fission chamber described was designed to meet the requirement for a more accurate determination of flux distribution in small core assemblies. The dimensions of the chamber for this purpose had to be kept as small as possible. The fissionable material used was U^{235}, the filling gas was argon at 10 atmospheres, and the operating potential—44 volts. (auth)

3054 CF-57-10-61
Oak Ridge National Lab., Tenn.
EVALUATION OF GAMMA-RAY ATTENUATION TECHNIQUES FOR MEASURING THE DENSITY AND HOMOGENEITY OF THORIUM OXIDE SLURRIES CIRCULATING AT 300°C. M. Richardson and A. S. Kitzes. Oct. 10, 1957. 47p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

The feasibility of using γ-ray attenuation techniques was demonstrated in determining the density and homogeneity of slurries circulating at 300°C. The method appears to have general utility in the engineering studies of slurry because the equipment is mounted externally and does not interfere with the system under investigation. Two types of detector systems were evaluated for routine service. The decimal counter-recorder system was found more adaptable for rugged operations, whereas the single channel analyzer was found to be more accurate and flexible. (auth)

3055 CWLR-2174
Chemical Warfare Labs., Army Chemical Center, Md.
DESCRIPTION OF AERIAL RADIOLOGICAL SURVEY METHODS. John P. Johnson and Manfred Morgenthau. July 12, 1957. 14p. Project 4-12-10-007-02.

Three aerial radiological survey methods, which have been used in connection with nuclear weapons tests, are discussed. The helicopter-to-ground method is the only one which provides the same degree of accuracy as ground survey. It is especially adapted for accurate short-range survey work. The standard-equipment method requires a minimum of preparation and equipment and may be suitable for certain situations where rather large errors may be tolerated. The long-range method is best suited for rapid surveys of large areas when only the general level and extent of fallout radiation are desired. (auth)

3056 HASL-3
New York Operations Office. Health and Safety Lab., AEC.
BETA AND GAMMA DOSE RATES FROM TERRESTRIALLY DISTRIBUTED SOURCES. Keran O'Brien, Wayne M. Lowder, and Leonard R. Solon. Oct. 28, 1957. 16p. $0.50(OTS).

Dose rates in air and at various depths in tissue produced by concentrations of natural isotopes in the ground are calculated for both beta and gamma radiation. Calculated gonadal "screening factors" are within 4% of the experimental values reported by the British Medical Research Council. (auth)

3057 KAPL-M-RTF-1(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
AN AUTOMATIC NEUTRON FLUX SCANNER. R. T. Frost. Jan. 20, 1954. Decl. with deletions Mar. 13, 1957. 16p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40 (mf OTS).

A neutron scanning device is described which corrects automatically for the time decay of the radioactivity during scanning without recourse to an empirical decay curve and does not require knowledge of the exact time of reactor scram. (L.T.W.)

3058 KAPL-M-WPW-1
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G INSTRUMENT TUBE MOCK-UP TESTS. W. P. Walsh. Nov. 18, 1957. 24p. Contract W-31-109-eng-52. $4.80 (ph OTS); $2.70(mf OTS).

The sensitivities of B^{10}-lined proportional neutron counters, developed under a program for the improvement of proportional counters and fission chambers, were compared with that of similar commercial counters. The commercial counters used as a basis of comparison had been previously used to detect $^5/_6$ of the S3G start-up source at cold clean shut down conditions. It was concluded that two of the developmental counters, connected in parallel, had sufficient sensitivity to detect the S3G start-up source at cold-clean shut down conditions. (auth)

3059 POC/Data-49
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DESIGN ASPECTS OF PRECIPITATOR FISSION PRODUCT DETECTORS. A. E. Herriott. Oct. 22, 1956. 58p.

This report summarizes the results of experimental and development work using the principle of collection of decay daughter products for fission product detection. It deals mainly with gas cooled reactors, but some of its findings may also be applicable to liquid systems. (auth)

3060 RIB-30
DuMont (Allen B.) Labs. Tube Research Div., Passaic, N. J.
DEVELOPMENT OF PHOTOMULTIPLIER TUBES. Report No. 26 [for] May 1, 1957 to July 31, 1957. F. W. Schenkel and Philip A. Snell. 16p. Contract AT(30-1)-1336. $0.50(OTS).
(See also RIB-16.)

3061 WAPD-PWR-RD-400
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MULTIPURPOSE INSTRUMENT HEAT SOURCES AND FLUX MONITORS. M. McKeehan and J. Sherman. Jan. 14, 1957. Decl. Mar. 13, 1957. 2p. $1.80(ph OTS); $1.80(mf OTS).

A Cu—U^{235} alloy was prepared which generates heat when exposed to a neutron flux. Methods of safely installing this alloy in a multipurpose reactor instrument are described. (D.E.B.)

3062
MEASUREMENTS OF RELATIVE BETA DEPTH DOSES IN TISSUE EQUIVALENT MATERIAL. Gunnar Walinder (Inst. of Radiophysics and Radiumhemmet, Karolinska Sjukhuset, Stockholm, and King Gustaf V Jubilee Clinic, Gothenburg, Sweden). Acta Radiol. 48, 68-80(1957) Sept.

The "tissue equivalence", in beta sense, of different chemical compounds and mixtures is discussed. A scin-

tillation probe for beta-dose measurements is described. The depth doses from semi-infinite As^{76}, P^{32}, and Au^{198} sources have been measured with this probe and compared with the corresponding values from film measurements. (auth)

3063

STUDIES WITH A MODIFIED COLLIMATOR FOR USE WITH SCINTILLATION COUNTER FOR TOTAL BODY SCANNING. Joseph P. Concannon and Frances Bolhuis (Columbus Hospital, Chicago, Ill.). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 855-63(1957) Nov.

An inexpensive mechanical rack and rectangular slit collimator for total body scanning which is adaptable to conventional scintillation counters is described. (auth)

3064

PORTABLE RADON DETECTOR FOR CONTINUOUS AIR MONITORING. W. B. Harris, H. D. LeVine, and S. I. Watnick (U. S. Atomic Energy Commission, New York). Arch. Ind. Health 16, 493-8(1957) Dec.

3065

SIMPLE TECHNIQUES TO SHOW THE DISTRIBUTION OF COLLOIDAL GOLD 198 IN BODY CAVITIES. J. R. Mallard and Ann McKinnell (Hammersmith Hospital, London). Brit. J. Radiol. 30, 608-10(1957) Nov.

3066

A CHAIR FOR THE MEASUREMENT OF THYROID ACTIVITY WITH RADIOACTIVE IODINE. H. Besford, A. Sivyer, A. Quinton, D. H. S. Boyd, and E. W. Brain (Queen Elizabeth Hospital, Birmingham, Eng.). Brit. J. Radiol. 30, 611-13 (1957) Nov.

3067

DESIGN OF CONTINUOUS BAFFLE IN A SHORT LENS BETA-RAY SPECTROMETER. P. N. Mukherjee, M. K. Pal, M. K. Banerjee, and A. K. Saha (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 31, 531-8(1957) Oct.

A short lens beta-ray spectrometer has been set up following the calculations of Banerjee and Saha (1953). The spectrometer can measure upto 4-Mev electrons. The performance of the spectrometer is checked up using C_s^{137} source. A new and simple method of alignment of the spectrometer is proposed. Ring focussing is investigated by photographic method, and from the observed nature of the caustic envelope of the electron trajectories a continuous baffle is designed. With this new baffle system a resolution of 1.47% at a transmissions of 0.56% is obtained. (auth)

3068

ON THE STANDARD COSMIC-RAY NEUTRON MONITOR. Masahiro Kidama, Kazuaki Murakami, Hajime Takeuchi, and Yukio Miyazaki. J. Sci. Research Inst. (Tokyo) 51, 37-53(1957) June.

3069

PARAMETRON AND PUNCHED CARD RECORDER FOR THE STANDARD MESON MONITOR. Koichi Kamata (Cosmic-Ray Lab.) and Fukashi Sasaki (Univ. of Tokyo). J. Sci Research Inst. (Tokyo) 51, 54-68(1957) June.

The recording system for a standard meson monitor is described. A counter counts the number of pulses from the monitor and an I.B.M. machine punches the number of pulses on cards at 15 min intervals. (C.H.)

3070

ON THE STANDARD COSMIC-RAY MESON MONITOR. Shinkichi Kawasaki, Ichirō Kondō, Masami Wada, and Yukio Miyazaki. J. Sci. Research Inst. (Tokyo) 51, 107-37 (1957) Sept.

A standard cosmic-ray meson monitor has been constructed and set up. The monitor was designed in conformity with the general specifications designated by the IUPAP Sub-Commission on Cosmic Ray Intensity Variations (SCRIV). Telescopes of wide angle to total vertical hard components and oblique incident hard components were built together with the standard cubical telescopes. (auth)

3071

GUARDED-FIELD THIMBLE IONIZATION. L. A. W. Kemp and Barry Barber (London Hospital Research Labs.). Nature 180, 1116-17(1957) Nov. 23.

3072

INSTRUMENTATION IN AIRCRAFT FOR RADIATION MEASUREMENTS. F. J. Davis and P. W. Reinhardt (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 713-27(1957) Nov.

The six crystal, NaI scintillation gamma-ray detector used by the U. S. Geological Survey for the past several years in making radiation surveys through the United States and Alaska is described. It is shown that the variation of radiation with height above ground in the neighborhood of 500 ft can be adequately expressed by use of a buildup factor which varies proportionately with height. Measurements of point and broad sources are shown to compare well with theory. (auth)

3073

GAMMA-DETECTION EFFICIENCY OF ORGANIC PHOSPHORS. K. I. Roulston and S. I. H. Naqvi (Univ. of Manitoba, Winnipeg, Can.). Nucleonics 15, No. 10, 86 (1957) Oct.

A nomogram and accompanying curves are presented which make possible a rapid determination of the detection efficiency of an organic phosphor. (L.T.W.)

3074

SILICA VIALS IMPROVED LOW-LEVEL COUNTING. Bernard W. Agranoff (National Inst. of Health, Bethesda, Md.). Nucleonics 15, No. 10, 106(1957) Oct.

Since a high background results from naturally occurring K^{40} in the glass containers containing the phosphor mixture, various types of vials were examined. Replacement of the glass vial by one made of an inexpensive grade of silica produced over a three-fold reduction in background counts at tritium-counting voltages and a two-fold reduction for C^{14}. (L.T.W.)

3075

PHOTOGRAPHIC METHOD FOR MEGAROENTGEN DOSIMETRY. H. F. Nitka and D. P. Jones (Ansco, Binghamton, N. Y.). Nucleonics 15, No. 10, 128, 130-3 (1957) Oct.

The experimental method suggests a means of using printout paper to make a simple dosimetry ribbon. A section of such a ribbon could be attached to an object that is to be irradiated. After exposure it could be read visually to an accuracy of ± 30% without auxiliary equipment. Better accuracy is available with optical reading instruments. (L.T.W.)

3076

ALL-TRANSISTOR CIRCUITS FOR PORTABLE DETECTORS. G. G. Eichholz, G. E. Alexander, and A. H. Bettens (Dept. of Mines and Technical Surveys, Ottawa, Can.). Nucleonics 15, No. 11, 90-3(1957) Nov.

Several all-transistor circuits for portable radiation detectors are described. They are cheap and reliable and can be carried by hand or in the pocket. (L.T.W.)

3077

LIQUID SCINTILLATORS IN FILTER PAPER. A NEW DETECTOR. Jean-Claude Roucayrol, Erich Oberhauser, and Richard Schussler (Univ. of Saar, Homburg, Germany). Nucleonics 15, No. 11, 104, 106, 108(1957) Nov.

Filter paper has long been used as a support for radio-

active materials, but a disadvantage is that, in the case of soft betas, a large part of the radiation is absorbed. As a remedy, a method is suggested for impregnating the filter paper with a liquid scintillator. In this way, some of the energy of the particles that would otherwise be lost in the paper causes scintillations that can be detected all the more easily because the support has become fairly transparent. (L.T.W.)

3078

CONSTRUCTION OF METALLIC GEIGER-MUELLER COUNTERS. Z. Buja, A. Olés, and K. Ostrowski. (Mining-Metallurgical Acad., Warsaw.) Nukleonika 2, No. 2, 321-34(1957). (In Polish)

The design and performance of metallic Geiger-Mueller tubes are described. Operations of Geiger-Mueller counters for γ and β rays in laboratory research, the temperature dependence of the counters, and the performance characteristics are discussed. (R.V.J.)

3079

A WHOLE-BODY RADIOACTIVITY COUNTER FOR BED PATIENTS. J. F. Fowler (King's Coll. Hospital, London). Phys. in Med. and Biol. 2, 64-7(1957) July.

An arrangement of eight G-M counters is described which enables the whole-body radioactivity of bed patients, including weak semi-sitting cases, to be determined without significant positional errors. (auth)

3080

BUBBLE DENSITY IN A PROPANE BUBBLE CHAMBER. William J. Willis and Earle C. Fowler (Yale Univ., New Haven, Conn.) and David C. Rahm (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 1046-7(1957) Nov. 15.

Measurements of the number of bubbles per centimeter in a propane bubble chamber are described. A method insensitive to the effects which cause inefficiency in direct bubble counting was used, based on the distribution of bubble spacings. The number of bubbles per centimeter measured by using this method is consistent with the rate of delta-ray formation. (auth)

3081

A THEORY FOR HETEROGENEOUS ION CHAMBERS AND NEUTRON RESPONSE OF VICTOREEN DOSIMETERS. C. W. Sheppard, M. Slater, and G. J. Atta (Oak Ridge National Lab., Tenn.). Radiation Research 7, 342-56(1957) Oct.

A method is presented for the approximate estimation of the response to ionizing radiation of spherical-cavity ion chambers that are not of the homogeneous type. The calculations are applied in particular to the response of standard Victoreen x-ray dosimeters to fast neutrons, taking into account the attenuation of the reading by the air filling and by the graphite coating that lines the inner surface. (auth)

3082

ABSOLUTE MEASUREMENT OF W_{air} FOR SULFUR-35 BETA RAYS. Z. Bay, W. B. Mann, H. H. Seliger, and H. O. Wyckoff (National Bureau of Standards, Washington). Radiation Research 7, 558-69(1957) Dec.

3083

AVERAGE ENERGY LOST BY SULFUR-35 BETA RAYS PER ION PAIR PRODUCED IN AIR. W. Gross, C. Wingate, and G. Failla (Columbia Univ., New York). Radiation Research 7, 570-80(1957) Dec.

3084

DETERMINATION OF DISINTEGRATION RATE FOR GAMMA-EMITTING ISOTOPES. GOLD 198. W. Gross, C. Wingate, and G. Failla (Columbia Univ., New York). Radiology 69, 699-703(1957) Nov.

A method is described for obtaining disintegration rates of gamma-emitting isotopes from the rate of energy transfer to a surrounding medium as indicated by ionization measurements in a series of concentric spherical shell ionization chambers of varying gap widths. By calculating the expected rate of energy deposition in the medium per disintegration, the number of disintegrations is obtained. The accuracy of the method has been tested with gold 198, whose disintegration rate was known from other methods. (auth)

3085

IMPROVED LOW-LEVEL ALPHA-SCINTILLATION COUNTER FOR RADON. Henry F. Lucas (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 28, 680-3 (1957) Sept.

A low counter background is obtained by use of steel for the shell and quartz for the counter window, while marked improvement in the stability is obtained by coating the window with an electrically conducting layer of tin oxide. The distribution of radon and its daughters within the counter under various conditions was determined by comparison of observed and calculated counting efficiencies. A stable counting efficiency of 5.58 ± 0.05 cpm/$\mu\mu$c radon and a background counting rate of 0.08 cpm is obtained. The usefulness of this counter is augmented by adsorbing the radon on charcoal. The radon is then easily transferred to the counter with a small volume of helium and a Sigmamotor pump. This system is suitable for the analysis of samples of radon as small as 10^{-14} C or concentrations in air smaller than 10^{-15} C radon/liter. (auth)

3086

MEASUREMENT OF TRITIUM. C. Eaborn, E. Matsukawa, and R. Taylor (The Univ., Leicester, Eng.). Rev. Sci. Instr. 28, 725-6(1957) Sept.

3087

ELECTRON MOBILITY IN BORON TRIMETHYL. G. A. Ferguson, Jr. and F. E. Jablonski (U. S. Naval Research Lab., Washington). Rev. Sci. Instr. 28, 893-6(1957) Nov.

Boron trimethyl counters have operated successfully as neutron sensitive proportional counters. Differential pulse-height spectra for these counters show good resolution. The electron mobility in boron trimethyl is measured by the method of Nicholson in the X/P region from 0.8 to 7.0 v/cm/mm Hg. The data indicate a constant mobility above X/P = 2.5 volts/cm/mm Hg but the mobility increases rapidly for lower values. (auth)

3088

LOW-RATE NEUTRON DOSIMETER. Ira L. Karp (Boeing Airplane Co., Seattle, Wash.). Rev. Sci. Instr. 28, 902-4 (1957) Nov.

An instrument for monitoring of personnel in combined neutron and gamma radiation fields is shown to record the rem dose due to fast and slow neutrons and gamma rays. The instrument consists of a thermal neutron ionization chamber worn under the arm. The relative neutron to gamma response is trimmed by means of a gadolinium coating on the ionization chamber. The use of the human body as the moderator is discussed. (auth)

3089

FAST TIMING APPARATUS FOR MEASURING THE ARRIVAL DIRECTIONS OF COSMIC-RAY AIR SHOWERS. George W. Clark (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 28, 907-9(1957) Nov.

This paper describes a millimicrosecond timing apparatus for determining the arrival directions of extensive cosmic-ray air showers. The apparatus consists of four plastic scintillation detectors in a square array and a fast oscillograph with which one can determine the relative arrival times of the first shower particles which reach the

four detectors as indicated by the relative positions of pulses from the detectors on the oscillographic sweep. The uncertainty in determinations of the relative arrival times of the particles in a shower is about 3 millimicroseconds. The uncertainty in the determination of the arrival direction of a shower is about ±5°, and this uncertainty is caused primarily by the lack of coplanarity of the shower particles and not by instrumental limitations. (auth)

3090

NaI SUMMING SPECTROMETER. P. Shapiro and R. W. Higgs (U. S. Naval Research Lab., Washington). Rev. Sci. Instr. 28, 939-41(1957) Nov.

An extension of previous work on the analysis of pulse-height distributions obtained with gamma-ray sources placed inside well-type NaI(Tl) crystals is discussed. Two methods are given for the determination of the photopeak efficiency of these NaI spectrometers. It is shown that the summing property of the well-type crystal can be used to obtain the source strength and to yield information on the decay scheme of gamma-ray sources. The photofraction, photopeak efficiency, and resolution are given for a 5-in. diameter by 3-in. long NaI crystal with a 1-in. diameter well. (auth)

3091

MEASUREMENT OF THE IONIZING POWER OF PARTICLES IN A BUBBLE CHAMBER. G. A. Blinov, Iu. S. Krestnikov, and M. F. Lomanov. Soviet Phys. JETP 4, 661-70(1957) June.

The possibility of the measurement of the ionizing power of particles in a propane bubble chamber is demonstrated. The chamber was operating in conjunction with an accelerator. The use of the method of the reduction of pressure to a controllable constant level ensured the stability of chamber operation necessary for ionization measurements. The period of sensitivity was 40 msec. Measurements of the ionizing power of particles were carried out in the range up to eight times minimum ionization. It was found that the track density changes with the velocity of the particle as $1/\beta^2$ for $\beta < 0.6$. For velocities close to that of light, relativistic increase in the track density is observed. The used methods on the track evaluation are described. (auth)

3092

A BUBBLE CHAMBER FOR THE STUDY OF COSMIC RAYS. E. V. Kuznetsov, M. F. Lomanov, G. A. Blinov, and Chuan Chen-Niang(Khuan Shen-nian'). Soviet Phys. JETP 4, 773-4(1957) June.

Heretofore bubble chambers have not been used for the study of cosmic rays because of lack of control, since the life-time of the embryonic bubble formed by ionizing particles in going through the chamber was significantly less than the time in which the decompression occurs. However, bubble chambers can be used to study cosmic rays by increasing the efficiency of the chamber, that is, by increasing the fraction of the time in which the chamber is sensitive. The efficiency is determined by the sensitive time in each cycle as well as the length of the cycle. By shortening the cycling time and taking certain other precautions, the efficiency of the chamber has been increased so that it has become practical to work with cosmic rays. (A.C.)

Mesons

3093 UCRL-3924

California. Univ., Berkeley. Radiation Lab.

Σ^+ PRODUCTION BY Λ^0 HYPERONS. Frank S. Crawford, Jr., Marcello Cresti, Myron L. Good, Klaus Gottstein, Frank T. Solmitz, M. Lynn Stevenson, and Harold K. Ticho. Aug. 29, 1957. 11p. Contract W-7405-eng-48. $0.50 (OTS).

Two Λ^0 hyperons were observed to interact in flight with protons in a hydrogen bubble chamber. Σ^+ hyperons are produced in the interactions. The experimental data for the events are given and discussed. (auth)

3094

THEORETICAL STUDY OF THE MESIC HELIUM ATOM. M. Demeur and R. Lavalle. Bull. classe sci. Acad. roy. Bel. 43, 458-70(1957). (In French)

The electronic structure of a helium mesic atom has been investigated by means of the adiabatic approximation; it is shown that ionization occurs when the meson lies in the region of the electronic K-orbit. Auger effect has been studied in the case of an electron moving in the non-central field produced by nucleus and meson; it is pointed out that the transition remains essentially El. The molecular ion HeH^{++} has been investigated by the variational method with trial function $\exp(-\alpha\lambda-\beta\mu)$. (auth)

3095

POLARIZATION OF ELECTRONS IN MUON DECAY WITH GENERAL PARITY-NONCONSERVING INTERACTIONS. Toichiro Kinoshita and Alberto Sirlin (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 844-50(1957) Nov. 1.

The polarization of electrons in muon decay is studied in the case of the four-component neutrino theory with general parity-nonconserving interactions. The spectrum for each of the two states of longitudinal polarization is described by a set of three parameters of which only two are independent By observing the electron polarization in arbitrary directions, one can determine ten parameters of which six are related to the two longitudinal polarizations and the rest to the transverse part. It is seen that the prediction of the two-component neutrino theory about the electron polarization in muon decay is quite specific and can be distinguished from that of the general case, if the latter involves the interactions of the S, T, P types in charge-retention order. However, from the study of the polarization of electrons, it is impossible to distinguish the two-component theory from the four-component theory which involves only the vector-type interactions. It is noticed that the TCP theorem determines a detailed correspondence between the polarization dependence of the spectra for the μ^+ and μ^- decays. This provides us with an opportunity to determine experimentally whether weak interactions actually obey the TCP theorem or not. (auth)

3096

π^--PROTON INTERACTIONS AT 5 Bev. George Maenchen, William B. Fowler, Wilson M. Powell, and Robert W. Wright (Univ. of California, Berkeley). Phys. Rev. 108, 850-64(1957) Nov. 1.

The interaction of 5-Bev negative pions with protons has been studied by exposing a 36-atmosphere hydrogen-filled diffusion cloud chamber to π^- beams from the Berkeley Bevatron. One hundred and thirty-seven interactions producing charged outgoing particles were observed. Of these, 27 were elastic scattering events, 64 were inelastic collisions having two charged outgoing prongs, 39 had four prongs, 3 had six prongs, and 4 involved the production and visible decay of heavy unstable particles. The total cross section is estimated to be 22.5 ± 2.4 mb. The elastic scattering cross section is 4.7 ± 1.0 mb. The angular distribution of the elastic events is consistent with that expected for diffraction scattering from a sphere with radius $(0.9 \pm 0.15) \times 10^{-13}$ cm and opacity 0.6. Analysis of the inelastic events shows that multiple, rather than single, pion production is the predominant process occurring at this energy. An average of 2.3 secondary pions were produced in the inelastic events. This average multiplicity can be fitted by

the Fermi statistical theory only by increasing the interaction radius occurring in the theory by 20%. The statistical theory, however, fails to account for the rather marked asymmetry found in the c.m. angular distributions of some of the particles emitted in inelastic events. A combination of the four observed strange-particle production events with 11 similar events obtained in exposures to high-energy neutron and proton beams shows that pion emission accompanies strange-particle production in at least 60% of elementary-particle collisions at Bevatron energies. (auth)

3097

PRODUCTION OF Λ^0 PARTICLES IN LEAD AND CARBON BY 2.5-Bev PROTONS. E. R. Mosburg, Jr., E. C. Fowler, and H. L. Kraybill (Yale Univ., New Haven, Conn.). Phys. Rev. 108, 865-71(1957) Nov. 1.

In a systematic study of 18,000 pictures taken at the Cosmotron with the Yale diffusion cloud chamber, two Λ^0 decays were found having origin in a lead plate at the upstream edge of the chamber. With corrections for the geometric efficiency of the chamber and for the scanning efficiency, this leads to an upper limit of approximately 8 mb per lead nucleus for the production of Λ^0 particles. Thirty-seven nuclear interactions, found in the methane gas of the chamber, indicate a cross section of 155 ± 45 mb for star production in carbon. A two-dimensional Monte Carlo calculation of the internal pion-nucleon cascade in carbon was carried out for 45 events. Computed values for the π^+/π^- ratio and for the number of emerging charged pions per event are compared with those for the experimental carbon stars. It is concluded that the Monte Carlo calculation exaggerates the cascade and thus provides an upper limit to the multiplicity of cascade-induced events. A lower limit is provided by considering only the first collision of each Monte Carlo event. A count of the Monte Carlo fast internal pion collisions for which the production of a hyperon is energetically possible leads to an upper limit of 0.7 mb and a lower limit of 0.1 mb per carbon nucleus for Λ^0 production via the intermediate pion mechanism. Correction by Jastrow's lead-to-carbon production ratio yields Monte Carlo cross sections for lead which indicate that this mechanism may dominate over production in direct collisions between the incoming proton and internal nucleons. (auth)

3098

π^--NUCLEON INTERACTIONS AT 4.5 Bev. W. D. Walker (Univ. of Wisconsin, Madison). Phys. Rev. 108, 872-7 (1957) Nov. 1.

An emulsion study has been made of π^--nucleon interactions at a pion energy of 4.5 Bev. The percentage of elastic scattering at this energy seems slightly smaller than at energies slightly above 1.0 Bev. One can deduce from this that the range of interaction between π^- and proton is greater than 1.0 ± 10^{-13} cm. The inelastic interactions resulting in two prongs have been considered in some detail. The angular distributions are suggestive of a direct knock out of a pion by the incoming pion. The momentum distributions obtained recently from diffusion chamber work at Berkeley also seem to support such a model. The four- and six-prong events are more complicated. The data from all inelastic interactions indicate the nucleons seem to go strongly in the backward direction in the c.m. system. Thus none of the interactions seem consistent with the statistical model of pion production. (auth)

3099

PION-ELECTRON DECAY. M. Kawaguchi and K. Nishijima (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 905-7(1957) Nov. 1.

3100

ASSOCIATED PRODUCTION OF STRANGE PARTICLES BY 1.1-Bev π^- MESONS. J. L. Brown, D. A. Glaser, and M. L. Perl (Univ. of Michigan, Ann Arbor and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 1036-9(1957) Nov. 15.

The associated production of strange particles by 1.1-Bev kinetic energy π^- mesons by the reactions (1) $\pi^- + p \rightarrow \Sigma^- + K^+$, (2) $\pi^- + p \rightarrow \Lambda^0 + \theta^0$, and (3) $\pi^- + p \rightarrow \Sigma^0 + \theta^0$ has been studied in a 12-in. propane bubble chamber. The total cross sections in hydrogen for the reactions are 0.17 ± 0.04 mb, 0.22 ± 0.06 mb, and 0.21 ± 0.06 mb, respectively. In the $\pi^- - p$ center-of-mass, the Σ^- is produced in the forward direction while the Λ^0 and Σ^0 are produced in the backward direction. Lifetimes for the Σ^-, Λ^0 and θ^0 are found to be $(1.67^{+0.42}_{-0.26}) \times 10^{-10}$ sec, $(2.24^{+0.72}_{-0.43}) \times 10^{10}$ sec, and $(0.74^{+0.21}_{-0.10}) \times 10^{-10}$ sec, respectively. From various angular distributions of decay products, we find that the data are consistent with spin $\frac{1}{2}$ for the Λ^0 and Σ^- and spin 0 for the θ^0. The data are also consistent with parity conservation in strange-particle decay. (auth)

3101

Z DEPENDENCE OF POSITIVE PION PRODUCTION BY PHOTONS. William Imhof, Edward A. Knapp, Harry Easterday, and Victor Perez-Mendez (Univ. of California, Berkeley). Phys. Rev. 108, 1040-6(1957) Nov. 15.

The relative yield of positive pions from H, C, Al, Cu, Ag, and Pb produced by 335-Mev bremsstrahlung has been measured with a counter telescope at 5 angles to the beam line ranging from 45° to 150° and at 9 meson energies extending from 12 Mev to 125 Mev. The pion production cross sections at all angles and at all energies of 65 Mev or lower follow approximately a $Z/A^{\frac{1}{3}}$ dependence. Fair agreement with the optical model is obtained at the lower energies, provided account is taken of effects of the Coulomb potential and the potential arising from the pion-nucleon interaction. In the intermediate region from 22.5 to 65 Mev, the yields from the heavy nuclei are somewhat lower than predicted. At pion energies of 95 and 125 Mev, where the production cross sections follow more nearly a Z dependence, it is possible to get moderately good agreement with theory by considering the effects of the Coulomb potential on the production near the cutoff energy. (auth)

3102

PRODUCTION OF V PARTICLES BY 3-Bev PROTONS. R. L Cool, T. W. Morris, R. R. Rau, A. M. Thorndike, and W. L. Whittemore (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 1048-52(1957) Nov. 15.

With a well-collimated beam of 3-Bev protons and a hydrogen-filled diffusion cloud chamber a search has been made for V particles from p-p collisions. The rarity of such events leads to the conclusion that the V-production cross section is probably less than 0.2 mb. This value is significantly smaller than the ~1 mb V-production cross section observed for π^--p collisions at comparable center-of-mass energies. At the same time a cross section of 7.4 ± 1.5 mb is obtained for iron (per nucleus). A direct comparison of p-p and p-Fe interactions under essentially similar conditions allows us to conclude that an interaction with an iron nucleus is at least 4 times more effective in producing V°s than is an interaction with a free proton. (auth)

3103

MESON-MESON INTERACTION IN THE BETHE-SALPETER APPROXIMATION. A. N. Mitra and R. P. Saxena (Muslim Univ., Aligarh, U. P., India). Phys. Rev. 108, 1083-9(1957) Nov. 15.

The π-π interaction is studied in the Bethe Salpeter ap-

proximation by first obtaining the "effective" interaction Hamiltonian with the help of the lowest order S matrix for π-π scattering. This Hamiltonian is then used to set up a Goldberger-type integral equation for π-π scattering which is solved for the cases of total isotopic spins I = 0, 2, assuming the mesons to be in s states with respect to each other. It is found that the interaction in the state I = 0 is too strongly attractive to give a resonance. On the other hand, a resonance is obtained for the case I = 2, at a momentum (in the center-of-mass system) $k \sim 93$ Mev/c for each meson, taking $G^2/4\pi = 15.5$. (auth)

3104

NUCLEAR INTERACTION OF 140- TO 218-Mev K^+ MESONS. B. Sechi Zorn and G. T. Zorn (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 1098-9(1957) Nov. 15.

3105

PHOTOPRODUCTION OF PION PAIRS IN HYDROGEN. Michel Bloch and Matthew Sands (California Inst. of Tech., Pasadena). Phys. Rev. 108, 1101-2(1957) Nov. 15.

3106

DETECTION OF PARITY NONCONSERVATION IN Λ DECAY. F. S. Crawford, Jr., M. Cresti, M. L. Good, K. Gottstein, E. M. Lyman, F. T. Solmitz, M. L. Stevenson, and H. K. Ticho (Univ. of California, Berkeley). Phys. Rev. 108, 1102-3(1957) Nov. 15.

The decay reaction $\Lambda \rightarrow p + \pi^-$ was studied, and it is concluded that the degree of nonconservation of parity is very large and that charge conjugation invariance is also violated. (L.T.W.)

3107

TEST OF CHARGE-CONJUGATION INVARIANCE IN HYPERON DECAY. R. Gatto (Univ. of California, Berkeley). Phys. Rev. 108, 1103-4(1957) Nov. 15.

3108

CONSIDERATIONS ON DEPOLARIZATION OF POSITIVE MUONS IN GASES; EFFECT OF MOLECULAR IONS. Vernon W. Hughes (Yale Univ., New Haven, Conn.). Phys. Rev. 108, 1106-7(1957) Nov. 15.

A brief discussion of various causes of depolarization is given with particular application to muons in gases. The additional depolarizing mechanism suggested is associated with the possible formation of a molecular ion by the attachment of a μ^+ meson to a neutral gas atom or molecule. (L.T.W.)

3109

INVESTIGATION OF σ STARS INDUCED BY NEGATIVE π-MESONS. S. A. Azimov, U. G. Guliamov, E. A. Zamchalova, M. Nizametdinova, M. I. Podgoretskii, and A. Iuldashev (Academy of Sciences, USSR and Academy of Sciences, Uzbek, SSR). Soviet Phys. JETP 4, 632-6(1957) June.

The properties of σ-stars produced by π^- mesons stopping in an emulsion chamber were investigated. Data obtained from the analysis of 938 σ-stars were used to determine the distribution of the number of prongs as well as the energy distribution of secondary particles. The obtained energy spectrum is compared to the data on σ-stars produced by K^--mesons. (auth)

3110

OBSERVATION ON THE NUCLEAR SCATTERING OF K^+ MESONS. N. N. Biswas, M. Ceccarelli, and N. Schmitz (Max-Planck-Inst. für Physik, Göttingen). Z. Naturforsch. 12a, 693-8(1957) Sept. (In German)

3111

PRODUCTION OF NEUTRAL π-MESONS ON VARIOUS NUCLEI BY 260 TO 660 Mev PROTONS. Yu. D. Prokoshkin and A. A. Tyapkin (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 313-19(1957) Aug. (In Russian)

At various angles measurements have been performed of γ-ray yields resulting from the decay of π^0 mesons, produced on complex nuclei by 260 to 660 Mev protons. In this energy range the total cross sections of π^0-meson production on various nuclei have been determined. (tr-auth)

3112

ELASTIC SCATTERING OF 307 Mev π MESONS BY HYDROGEN. V. G. Zinov and S. M. Korenchenko (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 335-8(1957) Aug. (In Russian)

The angular distribution of π mesons elastically scattered on hydrogen was studied with scintillation counters. The energy of the incident π^- mesons was 307 ± 9 Mev. The π^- meson angular distribution obtained in the center-of-mass system can be satisfactorily described by the expression $d\sigma/d\omega = (0.56 + 0.42 \cos\theta + 1.1 \cos^2\theta) \cdot 10^{-27}$ cm^2 sterad^{-1}. Results of phase shift analysis carried out on the assumption that only S and P waves contribute to scattering are presented. From comparison of the obtained data with the dispersion relations it is concluded that the meson-nucleon coupling constant is of the order of 0.08. (tr-auth)

3113

ON THE PRODUCTION OF π MESONS BY PROTONS ON NUCLEI OF VARIOUS ELEMENTS. A. A. Anselm and V. M. Shekhter (Leningrad Physico-Technical Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 481-4(1957) Aug. (In Russian)

The dependence of the probability of formation of π mesons produced by collisions between protons and nuclei on the number of nucleons in the nucleus A was considered. Deviation from the $A^{\frac{2}{3}}$ law was ascribed to the effective attenuation of proton beams penetrating the nucleus. (tr-auth)

3114

ON K_{e3} DECAY. L. B. Okun. Zhur. Eksptl'. i Teoret. Fiz. 33, 525-6(1957) Aug. (In Russian)

Measurements were made of the energy distribution of electrons and mesons emitted in K_{e3} decay. The results permit identification of the variation of decay interactions, verification of the conservation of time parity, and determination of the strong interaction form factors $g(E_\pi)$ of these decays. (tr-auth)

3115

ON THE PRODUCTION OF MESONS IN HIGH ENERGY COLLISIONS. E. G. Bubelev (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 539-40(1957) Aug. (In Russian)

A detailed study was made of peripheral collisions of nucleons to specify and check the results given by D. I. Blokhintsev (CERN Symposium, Geneva, 1956). (R.V.J.)

3116

ON THE RANGE OF ACTION OF THE MANIFOLD FORCES BETWEEN Λ° HYPERONS AND NUCLEONS. V. I. Ogievetskiĭ (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 546-7(1957) Aug. (In Russian)

3117

MESONIUM AND ANTIMESONIUM. B. Pontecorvo (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 549-57(1957) Aug. (In Russian)

Studies were made of the mixed particle mesonium determined as the bound system (μ^+e^-) and antimesonium (μ^-e^+) with not forbidden mesonium–antimesonium transitions. (R.V.J.)

3118

ON THE POSSIBILITY OF $\pi \rightarrow e + \nu + \gamma$ DECAY. I. Yu. Kobzarev. Zhur. Eksptl'. i Teoret. Fiz. 33, 551-3(1957) Aug. (In Russian)

The probability of the $\pi \rightarrow e + \nu + \gamma$ decay is analyzed in the primary order of the theory of perturbations, where G is the constant of meson–nucleon interactions. (R.V.J.)

3119
ON A METHOD FOR IDENTIFICATION OF ANTIHYPERON Σ^-. N. I. Petukhova (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 553-4(1957) Aug. (In Russian)

The method for identification of antihyperons Σ^- in π^+-meson decay at rest in a photoemulsion is described. (R.V.J.)

3120
PRODUCTION OF NEGATIVE π-MESONS BY 660 Mev PROTONS ON NUCLEI OF VARIOUS ELEMENTS. A. G. Meshkovskii, Ya. Ya. Shalamov, and V. A. Shebanov. Zhur. Eksptl'. i Teoret. Fiz. 33, 602-5(1957) Sept. (In Russian)

The energy spectra and cross sections for production of π^- mesons have been measured at an angle of 45° with respect to the protons beam for Li, Be, Al, and Cu. The differential cross sections $d^2\sigma^-/d\Omega dE$ for 157 Mev π^- mesons have been measured for Ag and Pb. A conclusion concerning the dependence of the cross section for π^- meson production on atomic weight has been drawn for elements lying between Li and Pb. A comparison of similar results for π^0 mesons and π^+ mesons obtained in other works is carried out. (tr-auth)

3121
THE ENERGY DEPENDENCE OF THE ANGULAR CORRELATION IN $\pi^+-\mu^+-e^+$ DECAY. A. O. Waissenberg and V. A. Smirnitskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 33, 621-4 (1957) Sept. (In Russian)

The energy spectrum of $\pi^+-\mu^+-e^+$ positrons in photoemulsion and the energy dependence of the angular correlation in the $\pi^+-\mu^+-e^+$ decay have been studied. Coefficient A in the angular correlation formula $1 + A \cos \varphi$ is shown to increase with positron energy in accordance with the theory of two-component neutrino. (tr-auth)

3122
ON LANGRANGIAN INTERACTIONS OF K MESONS AND HYPERONS. V. G. Solovev (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 796-7(1957) Sept. (In Russian)

Consequences resulting from the conservation hypothesis for combined parity in all interactions were studied in relation to K meson and hyperon interactions. (R.V.J.)

3123
INTERACTIONS OF FERMIONS AND K_{μ_3} DECAY. S. G. Matinyan (Inst. of Physics, Acad. of Sciences of Georgian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 797-9(1957) Sept. (In Russian)

Studies were made of the energy spectrum of electrons and μ mesons and of the angular correlation between π meson and electron to determine the importance of the weak interactions of four fermions in the decay of K mesons into leptons ($K_{\mu 2}$, $K_{\mu 3}$, and K_{e3}). The variations of this interaction in K_{e3} and $K_{\mu 3}$ decay were investigated. (R.V.J.)

3124
DISPERSION RELATIONS FOR S- AND P-WAVE REACTIONS OF MESON PHOTOPRODUCTIONS IN FIRST APPROXIMATION 1/m. L. D. Solov'ev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 801-3(1957) Sept. (In Russian)

3125
VARIATION OF HYPERON THEORY. Ya. B. Zel'dovich (Academy of Sciences U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 829-31(1957) Sept. (In Russian)

Microwaves

3126 AECU-3594
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Technical Progress Report No. 2 (Quarterly Report No. 6) for June 1, 1957 to September 1, 1957. P. D. Coleman, M. D. Sirkis, R. C. Becker, R. J. Kenyon, H. A. Spuhler, and A. W. Swago. Sept. 15, 1957. 47p. Contract AT(11-1)-392. $7.80(ph OTS); $3.30(mf OTS).

Work on the present relativistic electron bunching accelerator (S-band rebatron) is concerned with improving the electron bunching, current and beam focusing, and the design of a portable prototype system. Most of the parts for this new machine were fabricated and tested and the construction initiated. A photograph showing the present stage of construction is given. Since an S-band rebatron cannot be scaled directly to X-band, a lower voltage X-band rebatron, followed by a short section of a linear accelerator could solve the problem. An Electronics Associates analog computer was received and is being programmed to explore the design problems. The numerical work of evaluating the TM and TE modes of teflon dielectric cavities is largely completed. New ideas and further modifications are being tried in Si crystal harmonic multipliers for use as sources for testing components. The new klystrons now being used permit driving the crystals harder, and hence improve the harmonic power. (For preceding period see AECU-3535.) (M.H.R.)

3127 NP-6495
Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
QUARTERLY PROGRESS REPORT NO. 47 [FOR] PERIOD ENDING AUGUST 31, 1957. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Oct. 15, 1957. 148p. Project 3-99-00-100. Contracts DA-36-039-sc-64637.

Progress is reported on physical electronics, microwave gaseous discharges, solid state physics, microwave spectroscopy, nuclear magnetic resonance and hyperfine structure, microwave electronics, atomic beams, frequency modulation, statistical communication theory, process analysis and synthesis, transistor and diode studies, statistical thermodynamics, circuit theory, network synthesis, microwave theory, and neurophysiology. (For preceding period see NP-6419.) (M.H.R.)

Molecular Properties

3128
THE INFLUENCE OF PROTON VOLUME ON THE POSITION OF ELECTRON LEVELS IN HYDROGEN AND DEUTERIUM. N. N. Kolesnikov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 819-21(1957) Sept. (In Russian)

Neutrons

3129 AERE-NP/R-1938
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ANALYSIS OF NEUTRON SPECTROMETER RESONANCE DATA. J. E. Lynn and E. R. Rae. July 1956. 45p.

Methods of analysis of the data obtained with slow neutron spectrometers are described. The data are obtained from transmission, scattering, capture, and fission measurements. It is shown how relationships between the resonance parameters are obtained, and how these relationships are combined to give values of the individual parameters. Detailed mathematical treatment is given in a series of appendices. (auth)

3130 CF-53-6-186
Oak Ridge National Lab., Tenn.
A COMPARISON OF THE STREAMING OF THERMAL NEUTRONS THROUGH IRON AND STAINLESS STEEL IN THE ORNL LID TANK (EXP. 37). E. P. Blizard, G. T. Chapman, and J. D. Flynn. June 30, 1953. Decl. Apr. 22, 1957. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Extensive data and calculations are presented on the streaming of neutrons in Fe and stainless steel. Various streaming mechanisms are discussed. (W.L.H.)

3131 CF-54-2-93(Del.)
Oak Ridge National Lab., Tenn.
NEUTRON STREAMING THROUGH AIR DUCTS. J. M. Miller and C. L. Storrs. Feb. 15, 1954. Decl. Apr. 9, 1957. 39p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Studies of neutron streaming through air ducts were continued. Fast-neutron dose rate measurements and thermal-neutron flux measurements were also made. The fast-neutron data were used to check the Simon-Clifford formula for neutron attenuation through ducts. Data are presented graphically and in tabular form. (C.H.)

3132 CF-57-11-15
Oak Ridge National Lab., Tenn.
AN ESTIMATE OF THE NONLEAKAGE PROBABILITY FOR BARE AQUEOUS HOMOGENEOUS U^{235} REACTORS. D. K. Trubey, H. S. Moran, and Alvin M. Weinberg. Nov. 8, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The slowing-down distribution, to thermal energy, of neutrons from a U^{238} fission source in an infinite H_2O medium up to 160 cm was determined from experimental data. The Fourier transform of this distribution and the In resonance distribution, which are the nonleakage probabilities for bare reactors, were also determined. (auth)

3133
SLOWING DOWN OF NEUTRONS IN INFINITE HOMOGENEOUS MEDIA. N. Corngold (Brookhaven National Lab., Upton, N. Y.). Proc. Phys. Soc. (London) A70, 793-801(1957) Nov.

A new integral equation governing the slowing down of neutrons in a homogeneous mixture of atoms was derived from the Boltzmann equation. The new equation reflects a view of the neutrons as propagating down the energy scale, whereas the Boltzmann equation expresses a collision balance. Unlike the Boltzmann equation the new equation lends itself to approximate solution by iteration and to the construction of an accurate variational principle for p, the resonance escape probability. Some numerical results are given. (auth)

3134
THE MEASUREMENT OF THE TOTAL INTENSITIES OF FAST NEUTRONS WITH NUCLEAR EMULSION AND ITS APPLICATION TO THE DETERMINATION OF THE ANGULAR DISTRIBUTION OF NEUTRONS FROM THE REACTION Li(d,n)Be. Emma Perez Ferreira and Pedro J. Waloschek. Publs. com. nac. energia atomica (Buenos Aires) Ser. fis. 1, No. 7, 115-28(1956). (In Spanish)

The nuclear emulsion technique has been used for the development of two methods for determination of fast neutron flux. Both methods consist in counting the recoil protons produced by a radiator exposed to a neutron beam. In one of them, the emulsion itself has been used both as radiator and detector of the protons; in the other one, the radiator was a paraffin block. Both methods have been used for the determination of the angular distribution of neutrons from lithium bombarded with 900 kev deuterons, from a 1 Mev cascade generator. There were performed 46 exposures between 0° and ±135° with respect to the deuteron beam. In each exposure, the total number of neutrons emitted in that direction with energies between 1 and 15 Mev has been determined. Because of the strong scattering of the neutrons by the materials of the target support, the results depend on the geometrical conditions of exposure. (auth)

3135
ABSOLUTE FLUX MEASUREMENT OF ANISOTROPIC NEUTRON SPECTRA WITH PROTON RECOIL TRACKS IN NUCLEAR EMULSIONS. J. H. Roberts (Northwestern Univ., Evanston, Ill.). Rev. Sci. Instr. 28, 677-80(1957) Sept.

A technique for the measurement of neutron spectra which is independent of neutron direction has been studied. The technique consists of measuring all proton tracks in a known volume of type C2 Ilford emulsion, in which shrinkage has been reduced by treating the plates with rosin. By a suitable differentiation of the proton spectrum the absolute flux of neutrons as a function of energy is determined. Rotated plates were exposed to 0.8 and 1.3 Mev neutrons. 4000 tracks were measured, and two peaks with a width ~150 kev at half-maximum were obtained. The statistical accuracy of the neutron flux in the two peaks is about ten percent. The flux determination was checked by a fixed C2 plate in which the conventional proton recoil method was used. Good agreement was obtained. (auth)

Nuclear Physics

3136 ANL-4659(Del.)
Argonne National Lab., Lemont, Ill.
PHYSICS DIVISION QUARTERLY REPORT FOR MARCH, APRIL, AND MAY, 1951. June 8, 1951. Decl. with deletions Feb. 12, 1957. 69p. Contract W-31-109-eng-38. $10.80(ph OTS); $3.90(mf OTS).

3137 ISC-901
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN PHYSICS FOR JANUARY THROUGH JUNE 1957. Sept. 11, 1957. 37p. Contract W-7405-eng-82. $1.00(OTS).

Deviations from the allowed spectrum shape observed in P^{32} β-decay are discussed. Coincidence data taken on Yb^{169} and Tb^{160} are reviewed. The directional correlation function for the 357 to 82 kev γ cascade in Cs^{133} following Ba^{133} electron capture decay was determined. The detection of trace oxygen impurities in metals by the β activity from x-ray bombardment appears feasible. Results obtained in tests of this method are reported. A pulse heating method for measuring the high-temperature specific heats of metals was developed and applied to Fe in the temperature range 25 to 1000°C. The results of electrical resistivity measurements made on Ni and Ni-alloys at temperatures between 25 and 1000°C are plotted. Discussions of the semiconducting properties of Mg_2Si and Mg_2Ge single crystals are included. (For preceding period see ISC-833.) (D.E.B.)

3138 ORNL-2389
Oak Ridge National Lab., Tenn.
APPLIED NUCLEAR PHYSICS DIVISION ANNUAL PROG-

RESS REPORT FOR PERIOD ENDING SEPTEMBER 1, 1957. Nov. 26, 1957. 283p. Contract W-7405-eng-26. $6.50(OTS).

Progress is reported on light-water-moderated heterogeneous reactor research, UO_2–stainless steel Bulk Shielding Reactor design, design of a spherical Tower Shielding Reactor, critical experiments, resonance reactor development, fission physics, reactor physics and theory, shielding research, radiation detector development, and ion sputtering studies. (For preceding period see ORNL-2081.) (D.E.B.)

3139 UCRL-3914

California. Univ., Berkeley. Radiation Lab.
PHYSICS DIVISION QUARTERLY REPORT [FOR] MAY, JUNE, JULY 1957. Aug. 20, 1957. 58p. Contract W-7405-eng-48. $1.75(OTS).

Liquid hydrogen bubble chamber operation and development during the report period are summarized. Events observed in the 10-in. bubble chamber are tabulated. Binding energies, masses, and lifetimes of hyperons and K particles are reported from an analysis of hyperfragment and strange particle interactions. Information is reported on K^+ charge exchange, K scattering by protons, and π-μ decay. Brief status reports of studies in theoretical physics are included. Data are tabulated from scans of emulsions exposed to 500- Mev/c K^-. Evidence of the existence of the $(\frac{3}{2}, \frac{3}{2})$ isobaric nucleon is reported from the analysis of 522 multiprong events observed in n-μ Bevatron experiments. In connection with antiproton studies, a 200 Ilford G.5 emulsion was exposed to a total integrated proton flux of 4×10^{13} at the Bevatron. The details of the beam separation and focusing are given. Average values of the characteristics of antiproton annihilation obtained from the analysis of 100 stars are tabulated. An electrical-mechanical beam-pattern indicator developed for the 60-in. cyclotron is described. (For preceding period see UCRL-3782.) (D.E.B.)

3140 AEC-tr-3009

STATISTICAL WEIGHT OF A SYSTEM OF PARTICLES WITH ARBITRARY SPINS. V. S. Barashenkov and B. M. Barbashev. Translated from a publication of the Joint Inst. for Nuclear Research, U.S.S.R. Sept. 1957. 17p.

The use of recurrent relations instead of closed formulas simplifies the drawing up of tables of statistical weights of systems of particles with a given spin. Tables are drawn up for cases which are important to calculations in the multiple production theory for the energy range 10 to 15 Bev. (auth)

3141 AEC-tr-3028

MULTIPLE PRODUCTION OF HEAVY PARTICLES IN TWO NUCLEON COLLISIONS. V. S. Barashenkov, B. M. Barbashev, E. G. Bubelev, and V. M. Maksimenko. Translated from a publication of the Joint Inst. for Nuclear Research, U.S.S.R. 19p.

The probabilities of particle production in nucleon-nucleon collisions with the energy E = 3 Bev and E = 5 Bev were calculated using Fermi statistical theory and taking into account the conservation of baryon number, strangeness, and isotopic spin as well as strong resonance pion and nucleon interaction in the state $T = \frac{3}{2}$, $P = \frac{3}{2}$. Various cases of choosing effective space volumes in which secondary particles are produced were considered. (auth)

3142

ANOMALOUS MAGNETIC MOMENTS OF PROTON AND NEUTRON. S. K. Kundu (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys. 31, 526-30(1957) Oct.

The proton and the neutron magnetic moments have been calculated with a classical model consisting of spatially extended core charge and a meson cloud charge, both having spherical symmetry. (auth)

3143

EXPANSION OF SINGLE PARTICLE WAVE FUNCTIONS IN FUNCTIONS OF THE RELATIVE MOTION OF THE NUCLEONS. A. I. Baz'. Soviet Phys. JETP 4, 704-8(1957) June.

For small energies of relative motion, identical nucleons interact with each other only when their relative orbital momentum is zero. Therefore, it can be expected that a nucleon in the nucleus does not interact with all of the nucleons, but only with those three which are in an S-state relative to it. These considerations lead to a picture which is in many respects similar to the α-particle model of the nucleus. The wave functions of the shell model are investigated from this point of view and a number of common properties of the shell and α-particle models of the nucleus are shown. Several regularities in the binding energies of light nuclei are discussed. (auth)

3144

THE PHOTOPRODUCTION CROSS SECTION FOR POSITRONIUM IN AN EXTERNAL FIELD TAKING INTO ACCOUNT RADIATIVE CORRECTIONS. A. I. Alekseev (Moscow Tech. Physics Inst.). Soviet Phys. JETP 4, 771-3 (1957) June.

3145

NUCLEAR LEVEL DENSITIES. A. A. Ross (Univ. of California, Berkeley). Phys. Rev. 108, 720-5(1957) Nov. 1.

By using the statistical methods originally due to Bethe, the predictions for the densities of nuclear energy levels at excitation energies around 8 Mev are examined for two different versions of the shell model. A crude method is used to take into account the effects of shell structure. The assumed form of the theoretical expression for the density of nuclear energy levels is employed to analyze the data from slow-neutron resonance experiments and from fast (n,γ) cross sections. In contrast to earlier results, for the necessary potential radius, it is found that either the static diffuse potential with a radius of $\sim 1.2 \times 10^{-13} \times A^{\frac{1}{3}}$ cm, or the diffuse velocity-dependent potential based on the Johnson-Teller model with a radius of $\sim 1.4 \times 10^{-13} \times A^{\frac{1}{3}}$ cm, leads to fair agreement with the above experiments. In each case the values of the thickness of the surface layer on the nuclear potential and the magnitude of the spin-orbit coupling are taken to be those previously found to give close agreement with the experimental shell-model level sequences. The level-density expressions used here lead to an energy dependence which is in even stronger disagreement with those derived from various excitation function and inelastic scattering experiments than the empirical formula of Blatt and Weisskopf. It is argued that this anomaly may cast more light on the use of the statistical theory of nuclear reactions than on the validity of the expression for nuclear level densities. (auth)

3146

THERMAL-NEUTRON ACTIVATION CROSS SECTIONS OF Ge AND THE ISOMERIC RATIO RULE. E. der Mateosian and M. Goldhaber (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 766-8(1957) Nov. 1.

The thermal-neutron activation cross sections of Ge^{74} and Ge^{76} were determined. Contrary to indications obtained from previously published neutron cross-section compilations, results are in agreement with the isomeric ratio rule, which states that the ratio of cross sections for the production of two isomeric states by slow neutron capture is such that the isomeric state with spin close to that of the compound nucleus is favored. (auth)

3147
STABILITY OF PEAR-SHAPED NUCLEAR DEFORMATIONS. Kiuck Lee and D. R. Inglis (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 774-8(1957) Nov. 1.

The possibility of stable pear-shaped deformations of nuclei is treated by a perturbation theory starting from the nucleon wave functions of a spheroidal harmonic-oscillator potential, without spin-orbit coupling. The mixing of states of opposite parity tends to stabilize the deformation, and is opposed by the cohesiveness of nuclear matter that favors a spherical shape. The former is calculated explicitly for a number of cases and the latter is estimated by imposing a constant-volume condition in a simple manner closely analogous to a more familiar treatment of spheroidal deformations. In this approximation the mixing of the states is not quite enough to overcome the competing effect, so it merely "softens" the nucleus and does not stabilize a pear-shaped deformation. The most direct effect of spin-orbit coupling is to bring states of opposite parity closer together, tending to increase the mixing and make pear-shaped nuclei stable. (auth)

3148
DISTRIBUTIONS OF FISSION NEUTRON NUMBERS. James Terrell (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 108, 783-9(1957) Nov. 1.

It is shown, on reasonable assumptions as to the distribution of excitation energy among fission fragments, that the probabilities P_ν of observing ν neutrons from fission are given approximately, in cumulative form, by the "Gaussian" distribution,

$$\sum_{n=0}^{\nu} P_n = (2\pi)^{-1/2} \int_{-\infty}^{(\nu-\bar{\nu}+\frac{1}{2}+b)/\sigma} \exp(-t^2/2)dt.$$

In this equation $\bar{\nu}$ is the average number of neutrons, related to the average total excitation, b is a small adjustment ($b < 10^{-2}$), and σ is the root-mean-square width of the distribution of total excitation in units of the average excitation energy change E_0 per emitted neutron. It is shown that all experimental data on neutron emission probabilities are reasonably well represented by this distribution with $\sigma \cong 1.08$, with the exception of Cf^{252}, which requires $\sigma = 1.21 \pm 0.01$. An estimate that $E_0 = 6.7 \pm 0.7$ Mev gives an excitation energy distribution and a rate of change of $\bar{\nu}$ with incident neutron energy ($d\bar{\nu}/dE_n \cong 1/E_0$) in reasonable accord with experiment. These conclusions should also hold approximately for fission induced by higher energy neutrons, in which case a few neutrons may be emitted before fission. (auth)

3149
INFLUENCE OF SHELL STRUCTURE ON THE LEVEL DENSITY OF A HIGHLY EXCITED NUCLEUS. N. Rosenzweig (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 817-26(1957) Nov. 1.

Some features of the influence of shell structure on the level density of a highly excited nucleus (≃ 10 Mev) are studied on the basis of an idealized independent-particle model for which accurate formulas can be obtained in closed form. The theory is especially useful for estimating the ratio of the level densities of two nuclei in which the same degenerate (shell model) levels are being filled in the ground state, but which differ by a few units in the number of particles which occupy these levels. Observable effects persist to high energies (≃ 10 Mev) and they become very large in the neighborhood of the magic numbers. Thus, it is possible to determine experimentally whether or not the shell model of the nucleus retains any validity at high excitations. (auth)

3150
ELASTIC α ANGULAR DISTRIBUTIONS IN THE SHARP CUTOFF MODEL. J. S. Blair (Univ. of Washington, Seattle). Phys. Rev. 108, 827-36(1957) Nov. 1.

An analysis is made in terms of a semiclassical strong absorption model of all published angular distributions of intermediate energy alpha particles elastically scattered from heavy or medium weight nuclei as well as some examples of elastic proton and deuteron scattering. Moderately good agreement is found for radii obtained from different sets of data and also from analysis of fixed angle, variable energy experiments; there is some indication that the sharp cutoff radius increases as the bombarding energy is lowered to the Coulomb barrier. The connection between these results and optical model parameters is discussed. The best-fit critical angular momenta, l', are found to be essentially equivalent to the largest angular momenta, l_m, such that the l_mth potential barrier is classically surmounted by the bombarding particle when the most recent optical model parameters are used to represent the nuclear potential. It is suggested that, when the penetration depth is small, the most important "effective" parameter is l_m. (auth)

3151
VANISHING OF THE NEUTRINO REST MASS. K. Nishijima (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 907-8(1957) Nov. 1.

3152
MEDIUM-ENERGY DEUTERON PHOTODISINTEGRATION. N. Austern (Univ. of Pittsburgh, Penna.). Phys. Rev. 108, 973-81(1957) Nov. 15.

It is shown that the distinctive features of the photoeffect angular distribution in the energy range 20 to 100 Mev probably result from a strong modification of the $^3P_0$ outgoing wave amplitude, to be understood as a result of the excitation of virtual mesons in a fashion which violates the Siegert theorem. Some evidence also is found which suggests the need for a repulsive-core modification of the ground-state wave function. The contributions from the transition $^3D_1 \rightarrow {}^3F_2$ are analyzed, and are found to be rather large. (auth)

3153
MASS SPECTROMETRIC STUDIES OF THE INTERACTION OF GOLD WITH 3.0-Bev PROTONS. B. M. Gordon and L. Friedman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 1053-7(1957) Nov. 15.

Gold targets have been irradiated with 3.0-Bev protons and the yields of cesium, barium, and rubidium nuclides investigated by mass spectrometry. A high-sensitivity surface-ionization technique, using a multiple filament source arrangement and capable of determining (within 5%) 10^3 alkali metal atoms, was developed. The separation of products from the gold target was accomplished by extracting the gold into diethyl ether. The contamination level of stable Cs^{133} in the gold foil and reagents was determined by isotope dilution methods to be $\sim 9 \times 10^9$ atoms. Ratios of production cross sections for neutron-deficient cesium isotopes and their barium parents were calculated from mass spectra. Cross sections were placed on an absolute scale by a radiochemical determination of the Cs^{127} cross section. No cesium isotopes with A > 128 are formed in appreciable independent yield. An upper limit of 0.002 mb was placed on cross sections for Cs^{128} and the neutron-excess cesium isotopes. No stable cesium resulting from nuclear reactions was detected above the natural contamination background. Ratios of production cross sections for rubidium radioisotopes were determined. The natural contamination of rubidium was too large to place a meaningful limit on stable rubidium production. (auth)

3154

STATIONARY STATES OF AN ELECTRON-POSITRON SYSTEM AND ANNIHILATION TRANSITIONS. Chang Lee (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 365-78(1957) Aug. (In Russian)

A scheme is proposed which takes into account the effect of the external field and interaction between electrons and positrons when an electron–positron field interacts with a radiation field. If the photon energy is comparable with the electron rest energy, the theory is nonrelativistic with respect to particle momentum. If the photon energy is much smaller than the electron rest energy some relativistic corrections may be applied by taking into consideration higher approximations. The proposed scheme is applied to the stationary states of an electron-positron system and to two-photon positron annihilation in a many-electron system. Fock's self consistent field equations have been obtained for an electron-positron system. The probability of positron annihilation in a many-electron system is also derived. The particular case of annihilation in helium is considered. (tr-auth)

3155

ON MODULATION EFFECTS IN NUCLEAR MAGNETIC RESONANCE. K. V. Vladimirskii (Lebedev Inst. of Physics. Acad. of Sciences U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 529-30(1957) Aug. (In Russian)

Approximate expressions are given for effective cross sections of two electron-positron pair production during electron collisions with nuclei or with photons on nuclei. (R.V.J.)

3156

ON THE RADIATION INSTABILITY IN EXPERIMENTS ON NUCLEAR MAGNETIC RESONANCE. K. V. Vladimirskiĭ (Lebedev Inst. of Physics. Acad. of Sciences U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 532-3(1957) Aug. (In Russian)

The stability of the specimen-resonance contour system was investigated. It is shown that in conditions of self excitation the system can be used as nuclear magnetic generator and accelerator. (R.V.J.)

3157

ROTATIONAL LINES OF EVEN-EVEN PARITY AXIALLY SYMMETRICAL NUCLEI. A. S. Davydov and A. A. Chaban (Moscow State Univ.). Zhur. Eksptl'. i Teoret Fiz. 33, 547-9(1957) Aug. (In Russian)

3158

PHOTODISINTEGRATION OF THE DEUTERON AT ENERGIES FROM 50 TO 150 Mev. Yu. A. Aleksandrov, N. B. Delone, et al. (Lebedev Inst. of Physics, Academy of Sciences, USSR.) Zhur. Eksptl'. i Teoret. Fiz. 33, 614-20(1957) Sept. (In Russian)

Photodisintegration of the deuteron was investigated with the 265 Mev synchrotron with D_2O and H_2O targets by recording the protons with a telescope of two proportional counters. The differential cross sections were measured at angles of 22.5, 45, 67.5, 90, 112.5, 135, and 157.5° at γ-quantum energies of 54, 70, 88, 110, 129, and 148 Mev in the laboratory system of coordinates. The obtained angular distributions are compared with the calculations of Marshall and Guth. (tr-auth)

3159

CONCERNING RESONANCE SCATTERING OF γ-RAYS. N. A. Burgov. Zhur. Eksptl'. i Teoret. Fiz. 33, 655-9 (1957) Sept. (In Russian)

Experiments are suggested which may be applied in the determination of the width of excited levels and (if the experiments are of sufficient duration) of the correlation constants between the electron and neutrino and consequently to elucidate the problem of ascertaining the type of force involved in β decay. (tr-auth)

3160

ON THE THEORY OF NEUTRINO WITH ORIENTED SPIN. A. A. Sokolov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 794-5(1957) Sept. (In Russian)

3161

JUSTIFICATION OF THE OPTICAL NUCLEAR MODELS. P. Mittelstaedt (Max-Planck-Inst. für Physik, Göttingen). Z. Naturforsch. 12a, 675-8(1957) Sept. (In German)

Nuclear Properties

3162 KAPL-M-MLS-10

Knolls Atomic Power Lab., Schenectady, N. Y.

EPITHERMAL ABSORPTIONS IN HAFNIUM CONTROL SLABS. T. F. Ruane and M. L. Storm. Nov. 26, 1957. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Epithermal non-absorption probabilities ($\overline{P}_2$) at 68°F are computed for Hf slabs of varying thicknesses on the basis of available data on the resonance structure of the Hf isotopes. The values calculated for slab thicknesses of 0.1 and 0.2 in. agree within 13% with corresponding probabilities obtained by Deutsch employing an absorption area analysis of relative rod worths measured in a plastic critical assembly. A calculation of $\overline{P}_2$ for the 0.2 in. slab at 520°F yielded a 6% reduction in the value obtained at 68°F. Estimates of the effect of the above mentioned difference in values of $\overline{P}_2$ on the calculated safety margin of a specific core show that a 13% increase in $\overline{P}_2$ results in a decrease of 0.02 Δk in the shutdown condition. (auth)

3163 NRDC-65

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NEW NUCLEAR DATA ON THORIUM, URANIUM AND PLUTONIUM ISOTOPES. J. E. Sanders, comp. May 5, 1955. Decl. July 4, 1957. 9p.

3164 NRDC/82

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE YIELD OF FISSION NEUTRONS PER NEUTRON ABSORBED FOR Pu^{239} UP TO 60 eV INCIDENT ENERGY. F. J. M. Farley. Jan. 1956. 19p.

The yield of fast neutrons from Pu discs was measured with a high pressure methane counter for incident neutron energies up to 60 ev using the Harwell time of flight neutron spectrometer. By measuring the transmission of the samples under identical conditions, and correcting for scattering, the number of incident neutrons captured in the sample was obtained. The ratio η of the fast neutron yield to the number of incident neutrons captured was then calculated as a function of incident energy, the calibration constant being obtained by fitting to known values in the region 0.03 to 0.3 ev. The values of η fluctuate widely from resonance to resonance, but η appears to be constant within each resonance, and to change smoothly between resonances. A curve of the fission cross-section of Pu^{239} up to 60 ev is also presented. (auth)

3165 USNRDL-TR-160

Naval Radiological Defense Lab., San Francisco.

PROPOSED DECAY SCHEMES FOR SOME FISSION-PRODUCT AND OTHER RADIONUCLIDES. C. F. Miller. May 27, 1957. 118p. Project NS-083-001.

The photon energy and photon emissions have been summed for some fission-product and other radionuclides

using reported proposed decay scheme data up to about November 1956. The results are presented as proposed decay schemes giving the photon abundances per 100 disintegrations, the total photon energy emitted per disintegration, the average photon energy, and the number of photons per disintegration. (auth)

3166

ON THE STRUCTURE OF ATOMIC NUCLEI. Aage Bohr (Inst. for Theoretical Physics of the Univ., Copenhagen, Denmark). Am. J. Phys. 25, 547-53(1957) Nov.

A survey is given of interpretations of nuclear properties based on the two differing models of nuclear structure, the liquid-drop model and the shell model. These can be considered to be two approximate representations of a structure that is more complex than either. A more comprehensive model is discussed and shown to facilitate interpretation and correlation of the ellipticities of some nuclei indicated by the hyperfine structure of spectra, of rotational gamma-ray spectra, and of the process of Coulomb excitation. (auth)

3167

THE OVERHAUSER EFFECT IN LIQUIDS. Joseph Seiden. Compt. rend. 245, 1528-31(1957) Oct. 28. (In French)

3168

RADII OF "MIRROR" NUCLEI. Georges Mouchitzky. J. phys. radium 18, 567-71(1957) Oct. (In French)

Using the shell model, values of nuclear radius for mirror pairs have been calculated from the experimental values of Coulomb energy differences, as was made previously by Jancovici, Carlson, and Talmi. The harmonic oscillator well has been taken for the over-all potential, and Slater's method was used for calculating the energy perturbation due to Coulomb forces, from A = 3 to A = 17. The ratio of Coulomb to mesonic radius, as defined by Jancovici, and the value r_0 of the elementary nuclear radius were obtained in this way. (auth)

3169

EXCITED LEVELS OF Dy^{161}. Michel Vergnes. J. phys. radium 18, 579-84(1957) Oct. (In French)

The excited levels of Dy^{161} following the β desintegration of Tb^{161} have been studied. Three photons have been found of 25.5 to 49 and 74.5 kev, the latter being the cross over of the cascade formed by the first two: 49 kev, 25.5 kev. Two excited levels at 25.5 kev and 74.5 kev are so defined. The periods of these two levels have been measured: $T_{1/2}$ (25.5) = 2.7 ± 0.2 × 10^{-9} sec, and $T_{1/2}$ (74.5) = 2.3 ± 0.7 × 10^{-9} sec. The two photons of 25.5 and 74.5 have been found to be E1 (+ M2). The gamma transition of 25.5 kev is forbidden by a factor of about 10^4 compared to the single-proton estimate of Weisskopf. A level scheme is given. (auth)

3170

CHARGE DISTRIBUTION IN ATOMIC NUCLEI. (New Research Method). B. Kuchovicz (Inst. of Nuclear Research, Warsaw). Nukleonika 2, No. 2, 335-46(1957). (In Polish)

The problems of nucleonic charge distribution in the nucleus are studied. The radial distribution of nucleons, the energy levels of mesons, the scattering of fast electrons on heavy nuclei, and the Coulomb energy of nuclei are analyzed. Results show that $r_p = 1.2 \times 10^{-13}$ cm, which is in good agreement with the data obtained for heavy nuclei. (R.V.J.)

3171

NONELASTIC NEUTRON CROSS SECTIONS AT 14 Mev. Malcolm H. MacGregor, William P. Ball, and Rex Booth (Univ. of California, Livermore). Phys. Rev. 108, 726-34 (1957) Nov. 1.

Nonelastic neutron cross sections for 23 elements have been measured at 14.2 Mev by means of the sphere transmission technique. Corrections have been applied to the data, principally for elastic energy loss, multiple scattering, and finite detector size. The results are compared with predictions of the optical model. (auth)

3172

STATES IN O^{16} BETWEEN 12.67 AND 13.80 Mev. F. B. Hagedorn (California Inst. of Tech., Pasadena). Phys. Rev. 108, 735-43(1957) Nov. 1.

A study of the elastic scattering of protons from N^{15} is reported for proton energies between 600 and 1800 kev and for scattering angles from 75 to 160°. The technique for the preparation of the N^{15} targets is discussed. Anomalies in the scattering cross section are observed near incident proton energies of 710, 898, 1028, 1210, and 1640 kev, corresponding to states in O^{16} from 12.78 to 13.65 Mev. Analysis of these scattering data leads to the assignments $J = 0^-$, $J = 2^-$, $J = 1^-$, $J = 3^-$, and $J = 1^+$ for the 710, 898, 1028, 1210, and 1640-kev states, respectively. These assignments agree with earlier work except for the 710-kev resonance, which is reported here for the first time, and the 1210-kev level, which was previously reported to be $J = 4^+$. The angular distribution of the α-particles resonant at 1210 kev from the reaction $N^{15}(p,\alpha_1\gamma)C^{12}$ has been remeasured and requires $J = 4^+$ as was found previously. However, a measurement for the $\alpha-\gamma$ angular correlation function at 1210 kev is found to be consistent with $J = 3^-$ but not $J = 4^+$. This discrepancy has not been resolved, but the evidence favoring the assignment $J = 3^-$ is quite strong. Suggestions for the isotopic spin quantum numbers for these five states in O^{16} are made. (auth)

3173

GAMMA EMITTING STATES IN O^{16} BELOW 12 Mev. R. D. Bent and T. H. Kruse (Columbia Univ., New York). Phys. Rev. 108, 802-9(1957) Nov. 1.

A study has been made of states in O^{16} between 7.2- and 11.5-Mev excitation which belong to the sequence 0^-, 1^+, 2^-, 3^+, · · · (even angular momentum and odd parity, and vice versa). These states cannot break up into $C^{12} + \alpha$ but must decay by γ emission. The γ rays from the $F^{19}(p,\alpha\gamma)O^{16}$ and $N^{15}(d,n\gamma)O^{16}$ reactions were studied at bombarding energies up to 6.0 and 5.08 Mev, respectively, using a three-crystal pair spectrometer and other scintillation counters. The design, resolution, and efficiency of the three-crystal pair spectrometer are given. The ground state transition from the 2^-, 8.87-Mev state was observed to have 0.07 ± 0.02 the intensity of the 2.73-Mev cascade transition to the 3^-, 6.14-Mev state. A state was found at 10.98 ± 0.04 Mev which decays predominantly to the 1^-, 7.12-Mev state. No γ rays resulting from the decay of this state to other states of O^{16} were observed. The angular correlation of the 3.86- and 7.12-Mev γ rays shows a positive anisotropy of approximately 1. These results suggest a 0^- spin and parity assignment for the 10.98-Mev state. The predictions of the alpha-particle and shell models of O^{16} are compared with these results. (auth)

3174

EXCITED STATES IN Be^7 AND Be^8. J. C. Slattery, R. A. Chapman, and T. W. Bonner (Rice Inst., Houston, Texas). Phys. Rev. 108, 809-11(1957) Nov. 1.

The neutron-threshold method has been used to observe the neutrons emitted in the deuteron bombardment of both Li^6 and Li^7. From the bombardment of Li^6, two broad thresholds were observed corresponding to levels in Be^7 at excitation energies of 6.5 Mev (Γ = 1.2 Mev) and 7.2 Mev (Γ = 0.5 Mev). Four thresholds were observed in the bombardment of Li^7, corresponding to excited state ener-

gies in Be^8 of 16.07 Mev, 16.65 Mev, 17.60 Mev, and 18.19 Mev. (auth)

3175

EXCITED STATES IN Mn^{56}. J. W. Green, A. J. Smith, W. W. Buechner, and M. Mazari (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 841-3(1957) Nov. 1.

An electrostatic accelerator and a broad-range magnetic spectrograph were employed to investigate the excited states of Mn^{56} by means of the $Mn^{55}(d,p)Mn^{56}$ reaction. The proton groups from thin manganese targets were observed at 10, 30, and 60 degrees with an incident deuteron energy of 7.0 Mev and at 20 degrees with 6.6-Mev deuterons. In the region of excitation in Mn^{56} up to 7 Mev, 124 excited states were found. The ground-state Q-value for the reaction is 5.047 ± 0.005 Mev, and the first excited state is at 0.025 ± 0.004 Mev. (auth)

3176

HYPERFINE COUPLING SPECIFIC HEAT IN COBALT METAL. C. V. Heer and R. A. Erickson (Ohio State Univ., Columbus). Phys. Rev. 108, 896-8(1957) Nov. 1.

Preliminary measurements of the atomic heat of metallic Co between 0.6 and 3.0°K indicate the existence of hyperfine coupling. (A.C.)

3177

LIFETIMES OF THE 6.91- AND 7.12-Mev EXCITED STATES OF O^{16}. C. P. Swann and F. R. Metzger (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 108, 982-8 (1957) Nov. 15.

The mean lives of the 6.91- and 7.12-Mev excited states of O^{16} have been measured through a nuclear resonance scattering experiment. The $F^{19}(p,\alpha)O^{16*}$ reaction was used as the source of Doppler-broadened gamma radiation. The relative intensities of the 6.91- and 7.12-Mev gamma-ray lines in this source were determined by observations of the associated alpha particles. From the magnitude of the resonance fluorescence effect and the angular distribution, mean lives of $(1.2 \pm 0.3) \times 10^{-14}$ second for the 6.91-Mev level and $(1.0 \pm 0.3) \times 10^{-14}$ second for the 7.12-Mev level were calculated. (auth)

3178

POSITIONS AND WIDTHS OF O^{17} LEVELS FROM 4- TO 6-Mev EXCITATION. Cornelius P. Browne (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 1007-14(1957) Nov 15.

The $O^{16}(d,p)O^{17}$ reaction was used to measure the positions and widths of O^{17} levels from 4- to 6-Mev excitation. Proton spectra were obtained at high resolution with a broad-range spectrograph. This instrument accurately measured the widths and shapes of the energy distributions of the proton groups arising from the wider levels. Disagreements among other experiments concerning the O^{17} levels are explained in terms of the large difference in level widths. A comparison of these directly measured widths is made with those obtained from neutron scattering experiments. The observed shape of the energy distribution is that predicted by resonance theory. The 0.87-Mev level is found to be single rather than double as recently suggested. Excitation energies obtained (in Mev) are 0.871 ± 0.004, 3.055 ± 0.004, 3.846 ± 0.005, 4.553 ± 0.006, 5.083 ± 0.010, 5.215 ± 0.005, 5.378 ± 0.007, 5.695 ± 0.005, 5.731 ± 0.005, 5.866 ± 0.005, 5.94 ± 0.015. Widths of levels 4, 5, 7, and 11 are (in kev) 40 ± 5, 95 ± 5, 28 ± 7, and 23 ± 10, respectively. The other levels have widths less than 8 kev. (auth)

3179

BREAKUP OF Be^{9*} (2.43 Mev). D. Bodansky, S. F. Eccles, and I. Halpern (Univ. of Washington, Seattle). Phys. Rev. 108, 1019-24(1957) Nov. 15.

The breakup of Be^{9*} from the 2.43-Mev state has been studied. The level was excited by inelastic scattering of 42-Mev alpha particles and the breakup was studied by examining coincidences between inelastically scattered alpha particles and particles from the breakup. It was found that decay from this state proceeds less than 10% of the time by neutron emission to the ground state of Be^8 and less than 1% of the time by gamma emission to the ground state of Be^9. The low neutron-emission probability is consistent with the usual $5/2-$ spin-parity assignment for this state. (auth)

3180

THE SCATTERING OF COLD NEUTRONS BY LIQUID HELIUM. P. A. Egelstaff and H. London (Atomic Energy Research Establishment, Harwell). Proc. Roy. Soc. (London) A242, 374-91(1957) Nov. 5.

The differential cross-section and the average energy loss of 45°K neutrons for scattering by liquid He have been measured at angles of scatter near 0 and 180° and for liquid temperatures from 1.6 to 5.2°K. From these data the second moments of the radial distribution function and the zero-angle cross-sections have been calculated. The latter are close to those given by the theory of density fluctuations in a liquid. The energy transfers cannot be explained in the absence of a liquid model. The backward scattering can be explained as either a free atom process or one in which phonons are excited. Data on the scattering of 45°K neutrons by the saturated He vapor at 4.2°K are given and it is concluded that the moments of the radial distribution function are larger for the gas than the liquid. (auth)

3181

EXCITATION OF NUCLEAR VIBRATIONAL LEVELS BY SCATTERING OF FAST NEUTRONS. E. V. Inopin (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 764-6(1957) June.

3182

LEVEL SHIFTS IN μ-MESIC HYDROGEN AND THE STRUCTURE OF THE PROTON. L. M. Afrikian (Academy of Sciences, USSR). Soviet Phys. JETP 4, 770-1(1957) June.

3183

THE HIGHLY EXCITED STATES AND β-TRANSITION OF SOME MEDIUM LIGHT NUCLEI. R. p. Strivastav (Max-Planck-Inst. für Physik, Göttingen). Z. Naturforsch. 12a, 679-93(1957) Sept. (In German)

The highly excited states and β transitions of medium light nuclei are discussed theoretically, with particular reference to O^{16}, N^{16}, F^{16}, F^{17}, F^{18}, and O^{15}. (J.E.D.)

3184

CLASSIFICATION OF NUCLEAR MAGNETIC MOMENTS. I. A. Vaisman. Zhur. Eksptl'. i Teoret. Fiz. 33, 412-15 (1957) Aug. (In Russian)

It is proposed that the regions of maximum concentration of the nuclear magnetic moment values be designated by introducing along with the Schmidt and Dirac lines some lines as boundaries of these regions. Empirical data are presented as a proof of the real significance of these lines. It is noted that the quenching of the anomalous part of the nucleon magnetic moment in nuclear matter, which takes place besides of the effect due to the deformation of the nucleus, is apparently more important for formation of the nuclear magnetic moment than is usually considered. (tr-auth)

3185

POLARIZATION OF PROTONS SCATTERED ON O^{16}. SPIN AND PARITY OF THE 3.11 Mev LEVEL IN THE F^{17} NUCLEUS. P. V. Sorokin, A. K. Valter, et al. (Inst. of Physics in Tech., Academy of Sciences, Ukraine SSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 606-9(1957) Sept. (In Russian)

Polarization of protons scattered on O^{16} nuclei is investigated in the 2.6 to 2.8 Mev energy range. The

measured value of the polarization, its resonance character, and sign imply that the 3.11 Mev nuclear level in F^{17} has the characteristics $(\frac{1}{2})^-$. (tr-auth)

3186
COLLECTIVE EXCITATION OF EVEN-EVEN ATOMIC NUCLEI. A. S. Davydov and G. F. Filippov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 723-9(1957) Sept. (In Russian)

Collective excitation of axially symmetric even-even nuclei is investigated. It is shown that excitations of this kind can be divided into two classes: those which involve and those which do not involve appreciable changes in the nuclear quadrupole moment. The energy of collective excitations is expressed in terms of only two parameters. (tr-auth)

3187
THE OPTICAL MODEL AND NUCLEAR SHELLS. P. E. Nemirovskii. Zhur. Eksptl'. i Teoret. Fiz. 33, 746-9 (1957) Sept. (In Russian)

Bounded states of a neutron are investigated in a potential field whose parameters are derived from the optical model of a nucleus possessing spin-orbital interaction. Agreement with the experimental data has been obtained for the sequence of single particle levels in nuclei which consist of a closed shell + α particle. (tr-auth)

3188
EFFECTS OF PROTON STRUCTURE ON THE LAMB SHIFT. E. V. Teodorovich (Moscow State Univ.). Zhur. Eksptl'. i Teoret Fiz. 33, 823-5(1957) Sept. (In Russian)

The divergence between the experimental and theoretical values for the Lamb shift in H, after accounting for the electromagnetic processes in fourth and partially fifth order and after mass corrections, was found to be 0.6 mg, which can be partially explained by the proton structure (smeared-out proton charge). (R.V.J.)

Nuclear Reactors

3189 AECD-3765
Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.
PERFORMANCE OF THE DISASSEMBLY EQUIPMENT. NYX Test Numbers 2.9.1, 2.9.3. L. Bernath and J. H. Thompson, Jr. Feb. 1953. 28p. Contract AT(07-2)-1. (DPXN-234). $4.80(ph OTS); $2.70(mf OTS).

The NYX testing of the component disassembly equipment comprised repeated operation of both the quatrefoil disassembly machine and the foil press and shear to evaluate the suitability of these machines to perform their design function with reliability and convenience of operation. During testing, both design and operational deficiencies were found and corrected. In general, both machines operated satisfactorily after modification. (auth)

3190 AECU-3591
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
DECAY HEAT REMOVAL SYSTEM; SYSTEM DESCRIPTION NO. 8. Dec. 6, 1956. 40p. $7.80(ph OTS); $3.30 (mf OTS).

The decay heat removal system of the PWR is described. (T.R.H.)

3191 AECU-3592
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
MISCELLANEOUS SERVICE LINES; SYSTEM DESCRIPTION. NO. 36. Aug. 5, 1957. 33p. $7.80(ph OTS); $3.30 (mf OTS).

Included in this system description are the most important miscellaneous services required in the reactor portion of the plant. (W.L.H.)

3192 AECU-3593
Internuclear Co., Clayton, Mo.
CALCULATION OF TEMPERATURES IN A TWO PASS CYLINDRICAL CORE USING AN IBM-704 COMPUTER. Nov. 5, 1956. 46p. [For Westinghouse Electric Corp. Bettis Plant. Subcontract No. 73-(14-481)]. (INTERNUC-8). $7.80(ph OTS); $3.30(mf OTS).

Attached to this report is a letter from Raymond R. Schiff, containing pertinent information, dated Jan. 28, 1957. 2p. (WAPD-S5W-NA-145).

The input for the program includes radial and axial power distributions and rules for combining them into three-dimensional power distributions, radially and axially variable local peaking factors, engineering hot channel factors, and geometrical data. The output consists of the average inlet and outlet temperatures for each pass, the maximum relative heat flux, outlet temperature, surface temperature, and normal channel temperature rise in each pass together with the location of each of these maxima and the heat flux distribution in each channel where one of the maxima occurs. The program allows very rapid evaluation of these quantities and permits calculation without the simplifying approximations usually involved in hand methods. The program was successfully applied to S5W problems and requires from 3 to 5 minutes of machine time for solution of a full-scale case. (M.H.R.)

3193 AERE-C/R-2334
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SOLUBILITY OF RADIOLYTIC GAS IN THE HOMOGENEOUS AQUEOUS REACTOR CORE SOLUTION. P. C. Davidge. Aug. 1956. Decl. July 15, 1957. 14p.

Declassified version of HARD-P/41.

The solubilities of deuterium and oxygen in the homogeneous aqueous reactor core solution are estimated from related published data. It is shown that within the accuracy of measurement, the dissolved gases in equilibrium with a gas phase containing a stoichiometric mixture of deuterium and oxygen will also be in stoichiometric proportion. The need to add excess oxygen to the core solution in order to minimize corrosion of stainless steel, is considered in relation to the concentration of dissolved oxygen remaining after catalytic recombination of deuterium and oxygen. (auth)

3194 AERE-PIPPA-WP/Memo-4
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DESIGN DATA FOR CIRCUMFERENTIALLY FINNED CARTRIDGES IN CYLINDRICAL CHANNELS. H. A. Roberts. Apr. 15, 1953. 15p.

Data are presented from studies on the friction factor, Stanton number, Reynolds number, and heat transfer coefficient for plain circumferentially finned uranium cartridges in cylindrical channels measured in an open atmospheric air rig. Sketches of the finned cartridge and test apparatus are included. (C.H.)

3195 AERE-PIPPA-WP/Memo-4(Suppl. 1)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DESIGN DATA FOR CIRCUMFERENTIALLY FINNED CARTRIDGES IN CYLINDRICAL CHANNELS. H. A. Roberts. June 22, 1953. 13p.

Data are presented from studies on the friction factor, Stanton number, Reynolds number, and heat transfer coefficient for plain circumferentially finned uranium car-

tridges in cylindrical channels measured in an open atmospheric air rig. (See also AERE-PIPPA-WP/Memo 4.) (C.H.)

3196 AERE-R/M-134
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A THEORETICAL INVESTIGATION INTO THE REACTIVITY CONTROLLED BY A BANK OF CONTROL RODS IN THE DIMPLE SHORT CORE. C. B. Crockett. July 1957. 16p.

Approximate control rod formulas have been used to calculate the reactivities controlled by a single control rod and a ring of control rods in a reflected core. Using the results of these calculations, the reactivity controlled by a bank of six control rods in the Dimple Short Core was estimated and found to be approximately 5.1%. This must be regarded as a crude approximation in view of the differences between the theoretical model and the actual configuration. Experimental data indicate that the reactivity controlled by the bank of rods is approximately 5.7%. (auth)

3197 AERE-R/R-2337
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
EXPERIMENTS WITH DIDO/PLUTO MOCK-UPS IN DIMPLE. D. Hicks. Aug. 1957. 48p.

A series of experiments carried out in Dimple with mock-ups of the Dido/Pluto reactors are described. The observed critical conditions for the clean void free reactor were found to be in considerable disagreement with the original estimates. The flux distributions in cores formed from fuel of two different enrichments (46 and 93% U^{235}, respectively) were measured. The reactivity controlled by the principal safety devices, by the empty experimental tubes, and by a number of specimens in the experimental holes have been determined by experiment and, where possible, compared with two group perturbation theory. In spite of the clean core reactivity discrepancy a self-consistent scale of reactivity was established which enables the criticality conditions for various loadings of the reactor to be predicted. It was not however possible to relate this static reactivity scale to the kinetic behavior of the reactor. (auth)

3198 AERE-R/R-2340
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
LIDO—THE ENGINEERING AND PHYSICS DESIGN. H. R. McK. Hyder, J. W. Weale, A. Green, E. D. Jones, C. J. Kenward, and P. J. Oram. Sept. 1957. 52p.

A detailed account is given of the reactor core, the instrumentation, the tank and water treatment plant and the building and services. Also included is a summary of the reactor physics, shielding and heat transfer calculations. (auth)

3199 AERE-R/R-2345
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MEASUREMENT OF THE MODERATING PROPERTIES OF DOWTHERM A. T. E. Blackman, J. R. A. Lakey, and G. Preston. Aug. 1957. 22p.

The spatial distribution of neutrons from a fission source in Dowtherm A was measured using In foils as resonance energy neutron detectors and U^{235} fission chambers as thermal energy neutron detectors. The parameters are given for multigroup diffusion kernels which closely represent the observed distributions. (auth)

3200 AERE-RP/P-1810
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
APPROACH TO CRITICAL EXPERIMENTS WITH SLIGHTLY ENRICHED URANIUM IN NATURAL WATER. V. S. Crocker, W. G. Davey, and K. R. E. Smith. July 1957. 28p.

3201 AERE-RP/R-1506
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN INVESTIGATION OF THE EFFECT OF VARIOUS REFLECTOR SYSTEMS FOR THERMAL REACTORS. D. A. Newmarch. Nov. 22, 1954. 28p.

Using a graphite moderated natural U assembly a series of experiments were carried out in order to determine the extrapolation lengths for various reflector systems. A two group study of various core-reflector systems was then made so that the experimental results could be used to estimate the effect of reflectors placed beneath a D_2O moderated reactor. (auth)

3202 AERE-RS/L-21
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
REACTOR FUEL CYCLES AND NEUTRON ECONOMY. Two Lectures to the Reactor School. F. W. Fenning. Mar. 1956. 20p.

3203 AERE-T/M-116
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DIFFUSION OF FISSION FRAGMENTS IN SLURRY FUEL ELEMENTS. W. M. Lomer. Oct. 1954. Decl. Aug. 1957. 7p.

In an earlier memo. (A.E.R.E. T/M 93) an estimate of a few microns diameter was given as the maximum size of slurry particle from which fission products could escape into the liquid phase. The system considered was UPb_3 solid—Pb liquid at 600°C. The assumption that the diffusion rates of fission products are not much changed by irradiation is investigated in detail, and also some of the other assumptions previously made about the particle stability of the slurry are discussed. The results of the previous memo. are confirmed; the main effects of irradiation which cannot be predicted are on the rates of sintering together of slurry particles and the bubbling which may result from rare gas release. (auth)

3204 ANL-5715
Argonne National Lab., Lemont, Ill.
HAZARDS SUMMARY REPORT ON THE OXIDE CRITICAL EXPERIMENTS. W. C. Redman, J. A. Thie, and L. R. Dates. Apr. 1957. 87p. Contract W-31-109-eng-38. $2.25(OTS).

A new zero-power reactor facility, designated as ZPR-VII, which is under construction at the Argonne National Laboratory is described. This facility will be used to supply physics design information required in connection with several phases of Argonne's boiling reactor program. A description of the first reactor system to be investigated in this facility and an assessment of the hazards associated with the planned program of measurements are included. The first system to be investigated will employ fuel in the form of pellets of a fired mixture of enriched UO_2 and ThO_2. These pellets will be approximately $\frac{1}{4}$ in. in diameter, stacked to a height of 5 ft within an Al jacket of $\frac{5}{16}$-in. outer diameter. These fuel rods will be grouped in a variety of arrangements within a $6\frac{3}{4}$-ft diameter tank which can be filled with D_2O. The construction, instrumentation, and control system of the ZPR-VII conform

with past practice at Argonne. This reactor system is unusually safe as a consequence of large negative temperature and void coefficients of reactivity. Large reactivity effects are virtually impossible to achieve other than through deliberate sabotage, and the inherent safety mechanisms make the reactor completely self-limiting with no damage for a 1% excess reactivity step and probably for a 2% step. In addition, the public hazard associated with an appreciably greater reactivity step is extremely small. (auth)

3205 ANL-5731
Argonne National Lab., Lemont, Ill.
THE EBR-I MELTDOWN— PHYSICAL AND METALLURGICAL CHANGES IN THE CORE. Final Report— Metallurgy Program 7.2.18. J. H. Kittel, M. Novick, and R. F. Buchanan. Nov. 1957. 81p. Contract W-31-109-eng-38. $2.25(OTS).

As a result of the partial meltdown which occurred in EBR-I on November 29, 1955, it was necessary to remove the core assembly from the reactor and to separate the enriched fuel section from upper and lower unenriched blanket sections. A temporary cave was constructed on top of the reactor in order to remove the core assembly, and at this time about one-fourth of the fuel elements were removed. In order to perform further disassembly operations under less hazardous conditions, the core assembly was shipped from the Idaho Division of Argonne National Laboratory, at the National Reactor Testing Station, to the Lemont, Illinois, site of the Laboratory, where disassembly was completed in a protective atmosphere. It was found that approximately 40 to 50% of the core had melted and reached temperatures ranging between approximately 850 and 1400°C, and that the molten portion had separated into three clearly defined zones characterized by different porosities. Densities of the zones ranged from 2.5 to 15.4 gm/cm^3, depending upon the degree of porosity. It was also found that molten fuel alloy had traveled upward 5 inches and downward 3 inches between the blanket rods. Chemical and mass spectrographic analyses indicated that relatively little mixing occurred in the core during the period in which it was molten, that the fuel alloy which penetrated the blanket sections originated primarily from outer part of the molten zone, and that the blanket did not enter the molten phase. Observations during disassembly of the core and subsequent simulated meltdown experiments indicated that the porous structure which formed in the molten core could have resulted from the vaporization of entrained NaK. (auth)

3206 ANL-5775
Argonne National Lab., Lemont, Ill.
THE COUPLED ASPECTS OF A FAST-THERMAL CRITICAL: ZPR-V. B. J. Toppel. Oct. 1957. 20p. Contract W-31-109-eng-38. $0.75(OTS).

ZPR-V is a zero-power, coupled fast-thermal critical assembly involving a dilute fast core and a H_2O-moderated, enriched U thermal annulus. The two regions are coupled through a natural U isolation blanket. This facility is useful in studying some of the properties of dilute fast reactor systems as well as those of coupled fast-thermal power breeders. Recent emphasis has been on the latter aspect of the problem and an investigation of the coupled aspects of the system has been made. An important parameter in the coupling concept is the division of reactivity. This can be determined by means of fast fuel substitutions and 1/v poisoning of the thermal annulus in conjunction with theoretical calculations. Auxiliary information obtained in such a procedure is the fast fuel worth throughout the core and the prompt neutron lifetime of the whole system. A second important parameter, S_1/S_2, is the relative number of neutrons emitted per unit time due to fast and slow fissions. Information regarding this quantity can be obtained with the aid of U^{235} and U^{238} fission distributions. Measurements of the above parameters were made for the case of a U^{238}:U^{235} atomic ratio of 5:1 in the fast core and a 1-in. isolation blanket. The fractions of reactivity in the fast core, blanket, and annulus are, respectively, 24, 14, and 61%; the prompt lifetime is 39.0 ± 3.0 μsec; the ratio S_1/S_2 is 0.43. (auth)

3207 BNL-403
Brookhaven National Lab., Upton, N. Y.
LIQUID METAL FUEL REACTOR IN-PILE FUEL PROCESSING LOOP (LOOP B): CONSTRUCTION, OPERATION, EXPERIMENTAL RESULTS. C. J. Raseman, H. Susskind, and C. H. Waide. Jan. 1957. 44p. (LMFR-13). $1.50(OTS).

A molten solution of natural U in Bi at 500°C was circulated through the Brookhaven reactor in a type 347 stainless steel system. The U–Bi stream leaving the reactor was equilibrated with He gas and fused salts to determine distribution coefficients for certain fission products between metal and salt and metal and gas phases. The solubility of Xe at 500°C and 1 atmosphere (Xe) was found to be 0.4 ppm and to provide a value of 1.3×10^6 for the Henry's law constant k in the expression $p = kx$. The removal of the Xe by reduction of its partial pressure as a result of the removal of blanket gas at reduced pressure was shown to be within LMFR design requirements. More than half the I (the Xe precursor) in the loop was found to concentrate on the vessel walls. Other fission products were also studied to determine the degree of deposition on the walls. Salt contacting experiments were conducted with a LiCl-KCl eutectic and a $MgCl_2$-NaCl-KCl eutectic, and the results agreed favorably with previous small-scale tracer experiments. Indicative of these results are the ranges of the partition coefficients (ppm in salt/ppm in metal) for the following fission products and the $MgCl_2$-KCl-NaCl salt: Cs, 400 to 1020; Ba, 342 to 480; Sr, 125; Ce, 3.17 to 3.82; TRE, 4.07 to 7.55; Zr, 0.03 to 0.14; Ru, 0.9; I, 48 to 235; and Po, 0.73 to 0.76. These are compared to U, for separation purposes, with coefficients of 0.03 to 0.06. The loop was operated continuously in the reactor for 6446 hours, at the end of which shutdown was forced by a heater failure Leakage was discovered at several points in the system, and it was decided to remove the loop from the reactor. (auth)

3208 CF-52-9-9(Del.)
Oak Ridge National Lab., Tenn.; Division of Reactor Development, AEC; and Division of Research, AEC.
CONFERENCE ON CLASSIFIED NUCLEAR AND REACTOR PHYSICS, OAK RIDGE NATIONAL LABORATORY, SEPTEMBER 10, 11, 12, 1952. Decl. with deletions Feb. 6, 1957. 66p. $10.80(ph OTS); $3.90(mf OTS).

Abstracts for the papers given at a reactor physics conference are collected. Included are abstracts on the startup of the Homogeneous Test Reactor, a description of the Homogeneous Reactor Experiment, results of boiling tests in the Materials Testing Reactor Make-up, critical assembly and experiments for the Argonne Neutron Production Reactor, results of exponential experiments on H_2O-slightly enriched U lattices and an analysis of these data, an analysis of ZPR-I results, comparative criticality studies of H_2O-moderated reactors, properties of graphite-moderated reactors, the fission cross section of U^{235}, U^{234}, and U^{236}, methods of analysis of slow neutron transmission in the neighborhood of nuclear energy levels, neutron widths in fission resonances, neutron total cross sections of Th and U^{238}, time of flight velocity selectors, a summary of cross section measurements in the intermediate energy

range, the thermal neutron capture cross section of Ac^{227}, diffusion lengths of thermal neutrons in H_2O, neutron behavior in and around cavities, the mean free path of thermal neutrons in heavy water, chemical binding effects in neutron moderation, measurements with an untamped U^{235} critical assembly, burst characteristics in the assembly of fissionable material, cross sections and enrichment of Pu isotopes, capture-to-fission ratios for U^{233}, cyclotron production of Po^{208}, measurements of η for U^{233}, U^{235}, and Pu^{239}, a high current proton accelerator, reactivity and theory of reactors, neutron flux measurements in reactors, the collective model of the nucleus, objectives of the Materials Testing Accelerator program, neutron yield from targets bombarded with protons and deuterons, spectra of 1- to 10-Mev neutrons from U, high energy nuclear reactions, cyclotron studies, reactions with high energy N nuclei, a two group analog flux simulator. (C.H.)

3209 CF-54-8-95
Oak Ridge National Lab., Tenn.
PRELIMINARY STUDY OF FAST NEUTRON GROUND AND AIR SCATTERING AT THE TOWER SHIELDING FACILITY. Aug. 23, 1954. Decl. Feb. 23, 1957. 52p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

Measurements of scattered fast neutrons made at the Tower Shielding Facility as a function of the reactor-detector altitude show a peak in intensity at an altitude of 15 to 20 ft for a reactor-detector separation distance of 64 ft. At this altitude the intensity is a factor of 2 larger than that observed at 200 ft. Within the experimental error of ± 2%, the intensity observed at 150 ft was the same as that observed at 200 ft, indicating that for a separation distance of 64 ft the ground-scattered contribution was small at these altitudes. Preliminary analysis of the data estimated this contribution to be between 2 and 5% of the total scattered neutrons. With the reactor radiating at an angle of 30 deg with respect to the reactor-detector axis, the attenuation in water of the neutrons scattered into the sides of the detector tank was approximately exponential with a relaxation length of 5.6 ± 0.2 cm in the direction normal to the shield surface. (auth)

3210 CF-55-8-190
Oak Ridge School of Reactor Technology, Tenn.
A FOOD STERILIZATION REACTOR. Reactor Design and Feasibility Problem. E. O. Guernsey, R. M. Ball, T. V. Kavanagh, C. T. McDaniel, G. T. Schnurer, and C. E. Whittle. Aug. 1955. Decl. Feb. 25, 1957. 157p. $0.80(OTS).

A study has been made to determine the feasibility of sterilizing beef with reactor produced γ radiation. Results of the study have been measured against specifications established by the U. S. Army Quartermaster Corps and against estimated results for meat sterilization with other sources of radiation. A conceptual design for a reactor–irradiation system, involving activation of medium in the blanket of a heterogeneous reactor, satisfies these specifications. It compares favorably with other sources of radiation. Further work to improve the reactor–irradiation system is recommended. (auth)

3211 CF-56-5-6
Oak Ridge National Lab., Tenn.
TEST OF APPR TYPE CONTROL ROD IN THE MTR. E. E. Gross and F. H. Neill. May 1, 1956. Decl. July 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

It has been proposed that one of the Materials Testing Reactor (MTR) Cd rods be replaced with an Army Package Power Reactor (APPR) type rod, consisting of enriched B^{10} dispersed in electrolytic Fe and clad with 304L type stainless steel. The change in worth of the control rod as a function of operation time for both the MTR Cd rod and the proposed APPR B rod is determined in terms of the change in thermal neutron attenuation with burnup of the absorber atoms. (M.H.R.)

3212 CF-57-10-2
Oak Ridge National Lab., Tenn.
REPORT OF SLURRY BLANKET TEST RUN SM-3. L. F Parsly, Jr. Oct. 15, 1957. 39p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Run SM-3 covered 947.4 hours of which 669.2 hours were on slurry. Behavior of the system with slurry concentrations of 200 and 400 g Th/l were explored. Modifications made to the loop since the end of run SM-2 gave a flow of 360 gpm vs 230 gpm previously, and the blanket inlet nozzles were cut down from 2 in. ID to $1\frac{1}{2}$ in. sch 80 pipe, giving a velocity of 35 ft/sec out of the nozzles. The slurry was found to be suspended apparently uniformly in the blanket under the operating conditions and also with the flow reduced to 300 gpm by reducing the alternating current frequency. A further reduction to 197 gpm appeared to give conditions similar to run SM-2, with a much more marked concentration gradient in the blanket. The run was interrupted at 947.4 hr by a pump bearing failure. (auth)

3213 CF-57-10-88
Oak Ridge National Lab., Tenn.
SURVEY OF PRESSURE AND DIFFERENTIAL PRESSURE INSTRUMENT TYPES FOR POSSIBLE APPLICATION TO HRE-3 SLURRY SYSTEM. H. D. Wills. Oct. 25, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS)

3214 CF-57-10-110
Oak Ridge National Lab., Tenn.
LIFE OF HRE-3 CORE TANKS. J. A. Larrimore. Oct. 21, 1957. 47p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Calculations have been made of the expected life of Zircaloy core tanks in the HRE-3 assuming 5 w/ml power density in the tank, considering possible cooling systems. If the inner surface film coefficient is 1000 Btu/hr ft^2 °F or better, a thick single-walled tank appears optimum. If the inner surface coefficient is only about 100, cooling of the core tank with either D_2O or ThO_2 slurry appears desirable or even necessary. (auth)

3215 CF-57-11-74
Oak Ridge National Lab., Tenn.
PRELIMINARY HRE-3 DESIGN DATA (REVISED TO NOVEMBER 15, 1957). J. C. Bolger, E. H. Gift, R. O. Maak, and R. C. Robertson. Nov. 29, 1957. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

3216 CF-57-11-83
Oak Ridge National Lab., Tenn.
POSSIBILITY OF PEROXIDE PRECIPITATION WHEN THE REACTOR CELL IS FLOODED. P. N. Haubenreich. Nov. 15, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

It is expected that after the Homogeneous Reactor Test has operated at high power, some maintenance operations will require flooding the reactor cell. Minimum temperatures for preventing peroxide precipitation from the fuel solution during flooding are plotted. (D.E.B.)

3217 CRRP-728
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
TWO-GROUP TWO-DIMENSIONAL FLUX DISTRIBUTIONS FOR SEVERAL PTR LOADINGS. R. M. Pearce. Oct. 28, 1957. 31p. (AECL-512).

Six PTR loadings were studied on the Datatron. Fast and slow fluxes, and fast and slow adjoint functions were obtained in the RZ plane assuming cylindrical symmetry. Three of the cases studied had internal H_2O thermal columns; these had radii 4.86, 10.70, and 13.61 cm. Two cases had internal graphite thermal columns with radius 25.28 cm; in one case the graphite column contained a central water portion with radius 4.86 cm. The final loading had no internal thermal column. (auth)

3218 CRT-725

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EFFECTIVE CROSS-SECTIONS AND NEUTRON FLUX DISTRIBUTIONS IN A NATURAL URANIUM ROD. APPLICATION TO ROD 683. S. A. Kushneriuk. Sept. 1957. 59p. (AECL-497).

Effective neutron cross-sections of U^{235}, Pu^{239}, Pu^{240}, Pu^{241} and Xe^{135} and the 2200 meters per second neutron flux distribution are calculated for an NRX natural U metal rod assuming that the neutron flux spectrum in a rod is maintained by a purely Maxwellian incurrent or a Maxwellian incurrent to which is added a 1/E component. Results are presented for incurrent temperatures of 20.44, 38, 227 and 427°C and for two rod media, the unirradiated rod and a uniformly loaded, irradiated rod. Deviations of our values of the effective cross-sections from those presented in CRRP-680[TNCC(CAN)-7] illustrate the effects that hardening of the Maxwellian spectrum and self-shielding in the Pu^{239} and Pu^{240} resonance regions have on the cross sections. An application of similar calculations to the analysis of rod 683 irradiation data is also discussed. (auth)

3219 DM-48

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

COMMENT ON AMERICAN STANDARD'S "AN EVALUATION OF HEAVY WATER REACTORS FOR POWER," PROJECT SIZE-UP REPORT ASAE-3, OCTOBER 1, 1957. W. B. Lewis. Nov. 18, 1957. 11p. (AECL-527).

For nuclear plants to compete with coal-fired plants the fuelling cost must be lower because capital costs are higher. Reasons are given for doubting whether light water reactors bearing high (14%) annual charges on capital could ever compete with coal at $8/ton. Large D_2O reactors, taking advantage of the three points mentioned should on the other hand compete readily. This may be found from the evaluation under review if one is allowed to substitute UO_2 for U metal at not too high a cost and to accept a price for fabricated Zr not much over $100/lb in the completed fuel. The discussion of fuelling costs in this comment introduces a presentation in terms of the cost of consumed fuel that shows clearly the difficulty facing light water reactors when fuelling costs have to be less than 2 mills/kwh as required in the U.S.A. and Canada. (auth)

3220 FIAT-SEN-R-1

Fiat. Sezione Energia Nucleare, Turin.

CALCOLI PRELIMINARI SULLA POTENZA ESTRAIBILE PER CONVEZIONE FORZATA DA UN REATTORE TIPO "SWIMMING POOL." (Preliminary Calculations on Power Extractable by Forced Convection from a "Swimming Pool" Reactor.) Arduino Potesta. Apr. 1957. 15p.

The extractable power is determined for swimming pool reactors with various coolant flow rates and either bare or reflected cores. Materials Testing Reactor-type fuel elements with 12 or 18 plates per element are considered. (tr-auth)

3221 FIAT-SEN-R-2

Fiat. Sezione Energia Nucleare, Turin.

VALUTAZIONE DELLA POTENZA MASSIMA ESTRAIBILE PER CONVEZIONE NATURALE DA UN REATTORE A PISCINA (SWIMMING-POOL). (Evaluation of the Maximum Power Extractable by Natural Convection from Swimming Pool Reactors.) A. Tettamanzi. Apr. 1957. 14p.

A parallelopiped reactor with Materials Testing Reactor-type fuel elements is considered. First, the maximum power extractable by natural convection from the central channel is calculated. Finally, by various configurations of the core and by two diverse neutron flux distributions the maximum extractable power of the reactor is recalculated. (tr-auth)

3222 FIAT-SEN-R-4

Fiat. Sezione Energia Nucleare, Turin.

DIMENSIONAMENTO DELL'IMPIANTO PER LA DEMINERALIZZAZIONE DELL'ACQUA NEL CIRCUITO PRIMARIO DI UN REATTORE TIPO "SWIMMING-POOL" DA 5 MW. (Dimensioning of the Plant for the Demineralization of Water of the Primary Circuit of a "Swimming Pool" Reactor of 5 MW.) L. Pizzi and A. Rosatelli. May 1957. 12p.

3223 FPP-9

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PROPOSAL FOR STEAM BOILER FOR CO_2 PRESSURIZED PRODUCTION PILE. K. B. Clarke. Feb. 25, 1948. 8p.

3224 FPP-12

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PERFORMANCE OF A CO_2-COOLED PILE IN A PRESSURE ENVELOPE. HEAT TRANSFER AND PRESSURE DROP CALCULATIONS. J. Hodge and J. Smith. May 6, 1948. 21p.

General equations are developed for estimation of the heat transfer and pressure drop in the coolant channels of a pile with finned slugs, using CO_2 at an inlet pressure of 5 atmospheres absolute as coolant. For various assumptions of values of pile length, coolant channel area, fin length, coolant gas inlet temperature, and coolant flow velocity, values of coolant outlet temperature and mass flow, maximum permissible rating of the channel and pumping power (as a fraction of output) required to overcome the pressure drop in the coolant channel only are obtained for each of the cases; the maximum sheath temperature was fixed at 400°C throughout. The detailed results are given. Interpolation for outlet temperatures of 275, 300 and 325°C, and the omission of cases where either outlet temperature is too low or pumping power too high, leads to the values given. Since the calculations were made, further experimental data on heat transfer have indicated a fin efficiency below that used in the report, so an addendum was prepared to demonstrate the effect of reducing this efficiency to 0.80 of the original value on a section of the results of which the typical value above is one. For given parameter values, the permissible Mw/ton in the string is reduced by about 10% and the pumping power increased by about the same amount. (auth)

3225 HARD(A)/P-21

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN INTERIM REPORT ON SOLUTION CONTROL CIRCUITS FOR THE H. A. R. C. L. Brown. Sept. 25, 1956. 12p.

A survey of methods of reactor control is made, and a review of the type of solution control circuit evolved for the only homogeneous aqueous reactors so far designed is presented. (W.L.H.)

3226 IDO-10029(Del.)

Idaho Operations Office, AEC.

SUPPLEMENT TO URANIUM PRODUCTION REACTOR

PRELIMINARY DESIGN REPORT. Nov. 5, 1954. Decl. with deletions Feb. 22, 1957. 69p. $13.80(ph OTS); $4.80(mf OTS).

This report is a supplement to IDO-10027 and IDO-10028.

This report pertains to the UPR and attendant facilities modified and designed to operate as a dual purpose reactor, and supplements the UPR Preliminary Design Report which was issued on August 1, 1953. In order to insure continuous production of isotopes and uninterrupted power output, two identical reactors, complete with instrumentation and piping, have been included. The results of studies of aluminum corrosion at elevated temperatures, which have been in progress at Argonne National Laboratory, form the basis for the maximum allowable sheath temperature used in this report. The operating power level of the reactor has been raised from the previous UPR value of 500 megawatts to 1,000 megawatts. At this power level, approximately 200,000 kilowatts of usable electrical energy can be generated. The reactor vessel, process piping, and related equipment are designed for a pressure of 1,000 psig. In general, the philosophy and technology which form the basis for the original UPR are applied to the UPR as a dual-purpose reactor. The estimated cost of engineering and construction for the entire plant, exclusive of fuel, source material inventory and real estate, is approximately $34,000,000. The entire scheme makes use of readily available standard equipment, requires a minimum of research and development, and can be engineered and constructed now. (auth)

3227 IDO-16386

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE SPERT-II REACTOR FACILITY; PRELIMINARY DESIGN REPORT. T. R. Wilson. Oct. 1, 1957. 22p. Contract AT(1[illegible]-1)-205. $0.75(OTS).

This report is essentially the text of a paper presented at the American Nuclear Society Meeting in Pittsburgh, June 10-12, 1957.

A summary of the preliminary design features of the SPERT-II Reactor Facility is presented. The SPERT-II Reactor is one of a series of SPERT (Special Power Excursion Reactor Tests) reactors which will be utilized to obtain experimental information on the kinetic behavior of reactors in order to provide additional information to the industry for the evaluation of reactor hazards. The primary function of the SPERT-II Facility is to permit a study of the influence of the prompt neutron lifetime on reactor transient behavior and reactor safety by providing for the use of various moderators and reflectors, especially light and heavy water. The vessel is designed so as to facilitate changes in core types and reflector types and their configurations. The reactor vessel and coolant system are designed for operation at pressures up to 300 psi, temperatures up to 400°F, and coolant flow rates up to 20,000 gpm. Both upward and downward coolant flow through the reactor core is permissible; however, since the facility is intended only as a transient test facility, no heat removal equipment is included. (auth)

3228 IDO-16418

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SUMMARY OF THE SPERT-I, -II, AND -III REACTOR FACILITIES. C. R. Montgomery, J. A. Norberg, and T. R. Wilson. Nov. 1, 1957. 34p. Contract AT(10-1)-205. $1.00(OTS).

A brief description and design data summary of each of the SPERT Reactor Facilities is presented. Engineering, operating, and physics data are tabulated for use as basic references. (auth)

3229 IDO-16426

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

HIGH PRESSURE WATER LOOP EXPERIMENTS IN THE MTR. D. C. King. Nov. 14, 1957. 24p. Contract AT(10-1)-205. $0.75(OTS).

A high pressure, high temperature water loop in the MTR is designed to simulate operating conditions of proposed reactors for the purpose of studying the stability of prototype fuel elements. There are presently five operating loops in the MTR with one being constructed and a seventh now in the design stage. There are also six loops proposed for the ETR. The high gamma flux in the MTR and ETR makes the design of the in-pile tubes one of the more difficult problems. This is discussed as well as the problem of the radiation effect on in-pile tube structural materials. Brief mention is made of the complexity of loop controls and some fuel element tests. The deposition of corrosion products in a radiation field is a problem peculiar to in-pile loops. This phenomenon and the failure of the WAPD-30 in-pile tube by corrosion of the 316-stainless steel tip are covered. (auth)

3230 IGE-TM-01

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

ANALYSIS OF LOAD DEFLECTION TEST ON THE SUPPORTING FEET OF CALDER HALL PRESSURE VESSEL (REACTOR 2). W. H. Irvine. Feb. 21, 1956. 6p. (IGC-TRDC/P-155).

Results of a load deflection test on the pressure vessel feet have been used to calculate the maximum stresses in the structure under operating, Wigner release and stress relief conditions. The values of these stresses are compared with those predicted theoretically. (auth)

3231 IGR-TM/S-080

Gt. Brit. Springfields Works, Springfields, Lancs, England.

CALCULATIONS ON THE BOWING CHARACTERISTICS OF VARIOUS PIPPA FUEL ELEMENTS. R. O. Hughes. Apr. 6, 1956. 15p. (NPOC/FEWP-43; TRDC/163).

The bowing of axially loaded bars and tubes with small initial bows, was calculated for the most severe conditions in Pippa, using Irvine's theory. A more exact solution was also obtained. (auth)

3232 KAPL-ADM-833

Knolls Atomic Power Lab., Schenectady, N. Y.

FEASIBILITY REPORT OF THE 10-KILOWATT THERMAL TEST REACTOR AT THE KNOLLS ATOMIC POWER LABORATORY. R. G. Luce and L. Cherubin. Nov. 14, 1952. Changed from OFFICIAL USE ONLY July 9, 1957. 70p. Contract W-31-109-Eng-52. $10.80(ph OTS); $3.90 (mf OTS).

The problems of operating the present thermal test reactor at levels above 10 watts are presented. The need for a reactor of higher power at this Laboratory is discussed. A proposed modification of the present reactor to operate at 10 kilowatts maximum power is outlined, including the principal characteristics of the reactor and its safety features. Various types of nuclear accidents that could conceivably occur are analyzed, and the magnitude of the corresponding energy release calculated. A survey of reactor material release from the building under different energy releases and weather conditions is included. The hazards analysis demonstrates that in the highly unlikely event of a nuclear incident a release of radioactive mate-

rials from the reactor room is most improbable. Under no circumstances would any dangerous contamination result except within the few hundred feet adjacent to the reactor building. Also under no circumstances will personnel of the Knolls Atomic Power Laboratory Site receive significant radiation, and only under highly unlikely conditions could a few people immediately adjacent to the reactor receive serious radiation. It is therefore concluded that the operation of this reactor at the Knolls Atomic Power Laboratory is safe under the conditions outlined in this report and cannot result in an injurious effect to adjacent society. (auth)

3233 KAPL-M-CRDM-4
Knolls Atomic Power Lab., Schenectady, N. Y.
GAS FILLED CONTROL ROD DRIVE MECHANISM STUDY. KAPL MEMORANDUM CRDM-4. J. R. Thompson. Nov. 13, 1957. 11p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

3234 KAPL-M-EDL-46
Knolls Atomic Power Lab., Schenectady, N. Y.
ONE HALF SCALE REACTOR INTEGRAL ORIFICE TEST. R. H. Stokes. July 17, 1953. Decl. Mar. 21, 1957. 11p. Contract W-3[1]-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

3235 KAPL-M-EDL-84
Knolls Atomic Power Lab., Schenectady, N. Y.
SIR MARK A ELECTRO-MECHANICAL DRIVE MECHANISM. Drawing No. T-7A7770 G1. Results of Test Program. E. W. Kunz. Dec. 8, 1954. Decl. Apr. 25, 1957. 71p. Contract W-31-109-Eng-52. $12.30(ph OTS); $4.50(mf OTS).

The characteristics of a Submarine Intermediate Reactor Mark A prototype electromechanical shim drive mechanism are given. Design changes made from the original design in order to make control improvements are briefly discussed. (L.T.W.)

3236 KAPL-M-EJ-5
Knolls Atomic Power Lab., Schenectady, N. Y.
S4G UNIT CELL SHOCK ANALYSIS. E. B. Johansson. Oct. 14, 1957. 94p. Contract W-31-109-Eng-52. $15.30 (ph OTS); $5.40(mf OTS).

The response of the SAR unit cells to a velocity shock applied to the submarine hull is calculated. It is concluded that the unit cells are adequate for a 4 ft/sec step velocity. Because of their mounting, with a clearance at one of the three supports, the unit cells are non-linear systems. The problem was analyzed by two different methods: (1) The elastic support with a clearance was replaced by an equivalent linear spring and the unit cell was approximated by a single degree of freedom systems; (2) The Unit cell was approximated by a 3-degree of freedom system, and the response of this lumped mass system was solved on the analogue computer. Good agreement was found between the two methods. The analogue was also used to predict the response of the unit cell in the medium weight shock test. (auth)

3237 KAPL-M-ELW-6
Knolls Atomic Power Lab., Schenectady, N. Y.
A BURNABLE POISON OPTIMIZATION STUDY. E. L. Wachspress. Dec. 5, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Thermal utilization variation is considered for reactors with unshielded enriched U^{235} as fuel and with one (shielded) burnable poison. A method is developed for determining optimum fuel, burnable poison, and permanent poison loadings as well as the burnable poison self-shielding which gives desirable mismatch characteristics. (M.H.R.)

3238 KAPL-M-JBS-9
Knolls Atomic Power Lab., Schenectady, N. Y.
MULTI-GROUP ANALYSIS OF PuO_2 POWER BREEDERS; PRELIMINARY RESULTS. J. B. Sampson and E. A. Luebke. Aug. 17, 1954. Decl. Oct. 23, 1957. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Several Pu-fueled power breeders have been analyzed by the multi-group method. The results indicate that a feasible reactor can be made having fissile and fertile material in the form of an oxide in both core and blanket. One possible reactor with 6 atoms U^{238} per Pu in the core and 43 volume % Na has a critical mass of about 450 kg, a breeding ratio of about 1.4 of which 0.66 is internal, and a power of about 800 Mw. Replacing the metal U blanket with U oxide results in no significant reduction in breeding ratio but makes possible more economical reprocessing of blanket material. Further calculations are planned. (auth)

3239 KAPL-M-LBV-4
Knolls Atomic Power Lab., Schenectady, N. Y.
HYDRAULIC CONTROL ROD. J. E. Barnes, Jr., H. H. Winkler, and L. B. Vandenberg. May 28, 1952. Decl. Mar. 12, 1957. 22p. Contract W-31-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

Tests were made on four piston cylinder combinations of a hydraulic control rod mockup. In each test excessive friction between piston or piston rings and cylinder prevented satisfactory performance. Runs were made accumulating 100 hours per test at temperatures between 500 and 1000°F without any noticeable change in frictional forces. Liquid metal techniques have advanced sufficiently to make this system practical if the friction can be reduced. (auth)

3240 KAPL-M-PPU-8(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
PROPULSION CONTROL DESCRIPTION S41/6-3; PROJECT SIR-SSN575(MARK B). Mar. 15, 1954. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

3241 KAPL-M-RAD-2
Knolls Atomic Power Lab., Schenectady, N. Y.
FUEL ELEMENT FAILURE DETECTION AND LOCATION-ESTIMATE OF SENSITIVITY D/N SYSTEM S3G. R. A. Dewes. Nov. 7, 1957. 30p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

An estimate of the sensitivity, expected neutron activities, and counting rates of the fuel element failure detection and location system for the Submarine Advanced Reactor is given. (T.R.H.)

3242 KAPL-M-RES-32
Knolls Atomic Power Lab., Schenectady, N. Y.
HEAT LOSSES FROM THE S3G/S4G REACTOR PRESSURE VESSEL, HEAD, AND MECHANISMS AND AMBIENT TEMPERATURES OF THE REGION UNDER THE TOP HAT. H. F. Larkin and G. O. Mueller. Sept. 20, 1957. 38p. Contract [W-31-109-eng-52]. $6.30(ph OTS); $3.00 (mf OTS).

3243 KAPL-M-RJA-1
Knolls Atomic Power Lab., Schenectady, N. Y.
STATISTICAL PROCEDURE FOR DETERMINATION OF HOMOGENEITY OF U-Zr FUEL PLATES FOR USE IN D1G-CWA. R. J. Allio. Oct. 25, 1957. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Specifications for internal homogeneity of U-Zr fuel plates produced for the D1G-CWA are presented. (W.L.H.)

3244 KAPL-M-RMM-2
Knolls Atomic Power Lab., Schenectady, N. Y.
SHOCK AND VIBRATION IN NAVAL REACTORS. R. M.

Mains. Oct. 31, 1957. 43p. Contract W-31-109-eng-52. $7.80(ph OTS); $3.30(mf OTS).

The problem of designing a reactor to withstand the shocks and vibration incident to shipboard service in Naval craft consists of three principal parts. First the loads must be defined in some rational manner, then the responses of the various reactor structures to these loads must be predicted, and finally the responses must be compared to some damage criteria to determine whether the design is adequate or not. A brief discussion of each of these major parts is given, and then a specific example is worked through to illustrate what is involved in the whole process. (auth)

3245 KAPL-M-SMS-23
Knolls Atomic Power Lab., Schenectady, N. Y.
A PRELIMINARY ANALYSIS OF THE THERMAL STATES AND THERMAL STRESSES IN THE S3G/S4G PRIMARY COOLANT SYSTEM PRESSURIZER DURING COLD-START-UP. J. C. Westmoreland. Apr. 25, 1956. 33p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

A preliminary analysis of the thermal states and thermal stresses induced in the S3G/S4G primary coolant system pressurizer during cold-startup has been made. It is indicated that the results are strongly influenced by the procedure followed during startup, and consequently the present study was made for two different cases. Results for these cases are presented, and their significance is also pointed out. One of the more important assumptions made is the quantity of heat which is applied at a constant rate during the heating period and this factor is taken as being 264 kw for the present analysis. Further, it has been found that with this heating rate and the assumed pressurizer configuration several critical stress regions occur in both cases studied, and suggestions for obliviating these conditions are also included. (auth)

3246 KAPL-M-SMS-43
Knolls Atomic Power Lab., Schenectady, N. Y.
EMERGENCY COOLING CONDENSER PERFORMANCE AS A FUNCTION OF SHIP'S ATTITUDE. L. N. Rib. [Oct. 1956]: 24p. Contract W-31-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

Based on the design parameters and the assumption that the steam drum level can be lowered to allow the condenser to operate at maximum capacity, values of maximum condenser capacity for near surfaced and submerged conditions are obtained. The condenser operation is analytically described and a method for solving the resulting set of simultaneous equations are discussed. The effects of ship attitude submergence depth, quality in the sea water coolant and increased size of sea water piping, on maximum condenser capacity are also considered. (auth)

3247 KAPL-M-SMS-45
Knolls Atomic Power Lab., Schenectady, N. Y.
PRIMARY COOLANT IMPURITY ACTIVATION AND ACCESSIBILITY TO COMPONENTS IN S3G/S4G LOWER REACTOR COMPARTMENT. F. C. Steiner. Nov. 28, 1956. 24p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The dose rate from primary coolant piping and equipment after reactor shutdown is the result of the activity of impurities in the primary coolant and of the activity of the crud film which is deposited on the internal surfaces of the primary coolant system. The primary coolant impurity activities are evaluated in the light of the observation that long-lived corrosion product impurities, primarily cobalt, tend to increase with prolonged operation of the reactor plant due to corrosion of stainless steel materials in the reactor. Based upon the values of the primary coolant impurity activities, the corresponding specific crud activities were calculated. From these, the anticipated composite crud activity was estimated; the latter is in general agreement with data obtained from S1W and S2W. In order to determine the surface activity, the amount of crud per cm^3 of surface area was estimated by extrapolation of available S1W and S2W data to be about 0.25 mg of crud per cm^2. Using this value and the calculated specific crud activities, the corresponding surface activities were determined. Finally, the dose rate resulting from the crud film and the primary coolant impurities was calculated at the surface of the piping and components such as the steam generator. The calculations indicate that with a purification flow rate of 6 gpm with the main coolant pumps at full speed, the dose rate after reactor shutdown at the surface of the main coolant piping will be about 95 mr/hr after operating one year at 30% reactor power, followed by six days at full power. The maximum dose rate during the life of the plant is not expected to exceed 150 mr/hr. (auth)

3248 KAPL-M-SMS-81
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G CORROSION PRODUCT ACTIVITY BUILDUP WITH A STAINLESS STEEL UNIT CELL. J. W. Sapp. Sept. 30, 1957. 33p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

In order to develop an improved reactor core for use in S3G/S4G utilizing steel fuel elements, KAPL has proposed that a unit cell made up of improved stainless steel fuel elements be inserted and tested in S3G Core 1. Since the insertion of this unit cell in S3G core 1 will effectively double the area of the stainless steel exposed to the coolant in the high neutron flux region, it is necessary to calculate the effects of this additional stainless steel on the buildup of long-lived corrosion product activities in the main coolant system. In addition, it is necessary to analyze the effects of stainless steel fuel on corrosion product activity buildup so that proper measurements and samples be taken in S3G Core 1 with the SS unit cell such that the effects of an all stainless steel core in S3G/S4G on plant accessibility and coolant purification can be properly assessed. (auth)

3249 KAPL-M-SMS-87
Knolls Atomic Power Lab., Schenectady, N. Y.
OPERATION OF IBM-650 PROGRAM FOR EMERGENCY COOLING ANALYSIS. I. R. Goodwin and F. J. Scheib. Nov. 21, 1957. 46p. Contract W-31-109-Eng-52. $7.80 (ph OTS); $3.30(mf OTS).

A number of additions and revisions made to the digital computer program for the evaluation of emergency cooling in the Submarine Advanced Reactor are summarized. (M.H.R.)

3250 KAPL-M-SMS-88
Knolls Atomic Power Lab., Schenectady, N. Y.
DECONTAMINATION OF THE S3G/S4G STEAM GENERATORS. F. C. Steiner. Nov. 25, 1957. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A method is presented for the chemical decontamination of the primary coolant side of the steam generators from radioactive crud deposits. The method does not require circulation of the decontamination solution through the main coolant system and the reactor vessel. (T.R.H.)

3251 KAPL-M-SSD-1(Rev. 2)
Knolls Atomic Power Lab., Schenectady, N. Y.
SAR COOLANT PURIFICATION SYSTEM. PRELIMINARY DESIGN DESCRIPTION. Oct. 31, 1955. 25p., 1 illus. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

The design and operation of the SAR coolant purification system are presented. (W.L.H.)

3252 KAPL-M-SWK-3
Knolls Atomic Power Lab., Schenectady, N. Y.
SIR PPA 27, 28 AND 29 — COMPOSITION AND DESIGN. S. W. Kitchen, G. B. Gavin, H. A. Palmer, and W. B. Wright. July 25, 1955. Decl. Apr. 30, 1957. 10p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

PPA-27 represents the next major design change in the series initiated by PPA-25. The geometry, volume, fuel, and steel inventory in PPA-27 are the same as in PPA-25, but the 53% Be volume fraction of PPA-25 has been replaced by polyethylene, Zr, and Al. The polyethylene disks (0.020 in.) and Zr disks (0.100 in.) yield a molar ratio of H:Zr close to one to represent zirconium hydride, while the Al mocks Na. For safeguards reasons, the steel end blanket of the core was removed at a reactivity cost of $0.40. PPA-28 was obtained by adding interstitial polyethylene (4446 g) and B to PPA-27, while PPA-29 was obtained by adding interstitial fuel (7295 kg) and peripheral B to PPA-27. (auth)

3253 KAPL-M-TOR-2
Knolls Atomic Power Lab., Schenectady, N. Y.
SECONDARY SAFETY SYSTEM, MARK A. T. O'Regan. Jan. 28, 1953. Decl. Mar. 11, 1957. 22p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The secondary safety rod for the Mark A Submarine Intermediate Reactor is described. The rod has a control effect of $\Delta k = 0.0174$ which may be obtained in $\frac{1}{2}$ sec. It is tripped if the normal controls do not respond to a scram signal. The rod is filled with B_4C powder and is driven into the reactor core by coil springs. It can be withdrawn and cocked by an electric motor. (auth)

3254 KAPL-M-WKA-10
Knolls Atomic Power Lab., Schenectady, N. Y.
MODIFIED CONTROL ROD PROGRAM FOR THE S3G. W. Kermit Anderson. Dec. 19, 1955. Decl. Mar. 13, 1957. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A proposed program to produce an optimum control rod for the Submarine Advanced Reactor is presented. (L.T.W.)

3255 NARF-57-48-T
Convair, Fort Worth, Tex.
CALIBRATION OF THE ASTR. J. C. Nance, comp. Nov. 1, 1957. 137p. Project 6(1-9964). Contract AF-33(600)-32054. (FZK-9-090).

The Aircraft Shield Test Reactor (ASTR) is a one Mw, Convair-built reactor designed primarily to provide a radiation source for airborne shielding studies related to the Aircraft Nuclear Propulsion project. Early experiments performed with the ASTR to determine its characteristics are reported. The purposes of the experiments were in general; to assemble all reactor components into an operating system, to determine the controllability of the reactor, to establish the important nuclear characteristics of the reactor, to establish an absolute low power calibration of the reactor, and to determine the linearity of reactor instrumentation. Results of the above experiments have proven the adequacy of the reactor system from the standpoint of safety, operability, and reliability. (auth)

3256 NRL-5025
Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART III. AN EIGHT-DECADE LOGARITHMIC AMPLIFIER FOR NUCLEAR REACTOR INSTRUMENTATION. G. F. Wall and M. P. Young. Sept. 5, 1957. 14p. Projects NR 543-002 and NR 543-003.

The logarithmic amplifier developed at NRL has a dynamic range of eight decades of current (10^{-11} to 10^{-3} amp), good accuracy, a high degree of stability with changes in heater voltages, and requires no range switching. The amplifier will give an output which is proportional to the logarithm of its input current, and the circuit employs a pentode as the logarithmic element. The amplifier has been used satisfactorily in a signal channel which provides power level and period information continuously for the NRL Research Reactor control system. Radiation detector current is fed directly to the control grid of the logarithmic element. A feedback amplifier holds the plate current constant by adjusting the screen grid voltage. The adjusted screen grid voltage is also used to drive a recorder directly. Although designed specifically for the NRL Research Reactor control system, the amplifier should find many uses in the field of nuclear instrumentation. (auth)

3257 NURG-M/57
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF RE-ENTRANT COOLING ON THE ATTAINABLE TEMPERATURE RISE RATIO IN GAS-COOLED REACTORS OF THE PIPPA TYPE. J. H. Bowen. Apr. 14, 1953. 10p.

A modified form of "Ginn's Equation" is obtained, applicable to central entry, re-entrant cooling. (auth)

3258 NURG-M/59
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
EFFECT OF GRAPHITE TEMPERATURE ON POWER SENT OUT BY PIPPA. J. H. Bowen. May 12, 1953. 12p.

A preliminary examination is made of the variation of electrical power output of Pippa type plants, with straight through and re-entrant cooling, over a range of mean graphite temperatures. (auth)

3259 NURG/M-61
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
P.I.P.P.A. FUEL ELEMENT PRESSURE AND TEMPERATURE TEST RIGS. V. L. Fontaine. May 15, 1953. 21p.

The test conditions are surveyed, and the mechanical construction and electrical circuits described. (auth)

3260 ORNL-1550(Del.)
Oak Ridge National Lab., Tenn.
THE TOWER SHIELDING FACILITY SAFEGUARD REPORT. L. S. Abbott, ed. June 9, 1953. Decl. with deletions May 4, 1956. 186p. Contract W-7405-eng-26. $1.00(OTS).

The site of the Tower Shielding Facility is described in detail. The reactor and associated facilities, operating procedures, and experimental program are described. Reactor hazards and safety measures are summarized. (C.H.)

3261 ORNL-2341
Oak Ridge National Lab., Tenn.
FUEL COSTS IN SINGLE-REGION HOMOGENEOUS POWER REACTORS. P. R. Kasten, T. B. Fowler, and M. P. Lietzke. Dec. 3, 1957. 64p. Contract W-7405-eng-26. $1.75(OTS).

The results obtained indicate that fuel costs based on non-steady-state conditions are less sensitive to increases in fuel-cycle time than are fuel costs based on equilibrium conditions. However, for operating times greater than about 10 years, the optimum reactor conditions (reactor conditions refer to the specified reactor diameter, fuel-processing cycle time, and fertile material concentration) were about the same as those obtained on the basis of equilibrium conditions. The corresponding fuel costs were about the same for either 10- or 25-year operating peri-

ods. Based on present-day U values ($40/kg for natural U and $15/gm for U containing 90% U^{235}) and 4% inventory charges, reactors processed at the end of 10-year operation appear to have fuel costs as low as 1.4 mills/kw-hr. This cost is about the same as that for reactor systems having fuel-processing cycle times of 1 to 2 years if for such systems the fixed charges for fuel processing and shipping are about 0.7 mill/kw-hr higher than for the batch-operated system. The optimum reactor conditions were a function of the inventory charge, effective fuel processing charges, reactor power level, fuel-feed value, reactor system, and the fission-product poisoning. Of the parameter values considered, the reactor system, power level, inventory charge, and the value of fissionable fuel had the greatest influence on the fuel cost. Changing the power level affected optimum reactor conditions significantly; however, optimum power density was relatively independent of power level. The variations in fission-product poisoning and fuel-processing charge considered here did not change fuel costs to a large degree, the individual effects usually being equivalent to about 0.1 mill/kw-hr. The addition of Li_2SO_4 in equimolar proportions to UO_2SO_4 in $UO_2SO_4-D_2O$ systems increased fuel costs by about 0.1 mill/kw-hr. This addition in $UO_2SO_4-H_2O$ systems had no effect on fuel costs because of the high poison-fraction already present due to the H_2O. Based on present-day U values, increasing the inventory charges from 4 to 12% for the D_2O systems increased the fuel cost by about 0.5 mill/kw-hr, while increasing the power from 100 to 1000 thermal Mw decreased fuel costs by about 1 mill/kw-hr. The influence of reactor composition upon fuel costs is due to the different values of η and fraction poisons associated with the different systems. The fuel costs for $ThO_2-UO_3-D_2O$ systems were about 1 mill/kw-hr lower than those for systems initially fueled with $UO_2SO_4-D_2O$. (auth)

3262 POC/Mem-37

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

THE USE OF ENRICHED URANIUM IN B.E.P.O. F. W. Fenning. May 19, 1950. Decl. July 4, 1957. 6p.

The possibility of replacing part or all the U in B.E.P.O. with 235-enriched U in order to increase the available excess k has been suggested. The time scale for production of enriched metal is such that it is desirable to proceed with the second charge with natural U and replace a part of this when enriched material becomes available. A preliminary theoretical investigation was made to find the degree of enrichment required to gain a few % in k for (a) 20 control channels replaced by enriched material of 0.8 in. diameter, (b) 40 central channels replaced by enriched material of 0.8 in. diameter, (c) complete charge enriched, and 0.9 in. diameter metal retained. The neutron flux distributions for (a) and (b) were examined to determine the maximum/average heat output per cartridge. In order to reduce this the metal diameter considered for the central region was 0.8 in. (instead of 0.9 in.). A reduction in diameter is also justified from the effect of enrichment on the rod diameter for optimum k in a fixed lattice. (auth)

3263 TRDC-P/44

Gt. Brit. Dept. of Atomic Energy. Industrial Group H. Q., Risley, Lancs, England.

PRINCIPLES OF CONTROL SYSTEM DESIGN. R. V. Moore. May 28, 1954. 8p.

3264 WAPD-C(PC)-31

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

A STUDY OF CHEMICAL CONTROL FOR PWR. Z. M. Shapiro, ed. Apr. 8, 1955. Decl. May 7, 1957. 131p. $19.80(ph OTS); $6.30(mf OTS).

The application of a chemical control system to the Shippingport Pressurized Water Reactor is discussed. Specifications of the control system, description of a reference design, and material considerations are included. (C.W.H.)

3265 WAPD-CDA(AD)-29

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

RADIATION DOSE RATES DUE TO FISSION PRODUCTS IN THE PWR PRIMARY COOLANT. F. W. Pement. [July 29, 1957]. 13p. $3.30(ph OTS); $2.40(mf OTS).

It is predicted that, with 1000 defective UO_2 fuel rods, the dose rate 1 ft from the 18 in. main coolant piping will decline from a steady-state value of 207 mr/hr at shutdown to a value of 136 mr/hr 24 hr later if the purification system continues in operation. If purification flow is interrupted at reactor shutdown, it is predicted that the dose rate will rise from the steady-state operating level to a maximum of 332 mr/hr at 8 hr after shutdown and then decline, with a 77 hr half life, to 300 mr/hr at 24 hr. The contribution of deposited crud to the dose rate is also evaluated. (M.H.R.)

3266 WAPD-CTA(MPA)-1456

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

S1W PORT STAINLESS STEEL STEAM GENERATOR. E. Landerman. Aug. 10, 1956. 49p. Contract [AT-11-1-GEN-14]. $7.80(ph OTS); $3.30(mf OTS).

Transgranular cracks were observed in tubes pulled from the port stainless steel boiler. Based upon the findings, it is concluded that the transgranular cracks observed in the port stainless steel boiler were caused by chloride stress. Thermal stresses from temperature changes or transients would tend to propagate cracks resulting from chloride stress corrosion. (W.L.H.)

3267 WAPD-FE-411

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

NON-DESTRUCTIVE TESTING SURVEY WITH EMPHASIS ON INSPECTION OF PWR FUEL ELEMENTS. E. A. Proudfoot and C. K. Starks. July 30, 1954. Decl. Mar. 19, 1957. 16p. $3.30(ph OTS); $2.40(mf OTS).

Because the common STR testing methods are inapplicable to the inspection of PWR fuel elements, an investigation of the less well known methods of nondestructive testing was conducted. This investigation consisted mainly of a literature search; however, some experimental work was done. (L.T.W.)

3268 WAPD-IC-67

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

A SIMPLE ANALOGY TO A NUCLEAR POWER PLANT. J. Nelson Grace. June 1952. Decl. May 1, 1957. 23p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

3269 WAPD-IC-145

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

ON-OFF TYPE CONTROL ROD SYSTEM. J. N. Grace. July 15, 1953. Decl. July 18, 1957. 5p. $1.80(ph OTS); $1.80(mf OTS).

The requirements for eliminating the regulator rod from STR Mark I are summarized. (T.R.H.)

3270 WAPD-MRP-70

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PRESSURIZED WATER REACTOR (PWR) PROJECT

TECHNICAL PROGRESS REPORT FOR THE PERIOD AUGUST 24, 1957 TO OCTOBER 23, 1957. 80p. Contract AT-11-1-GEN-14. $2.25(OTS).

A combination test of the FEDAL Control System with the multiport valve was completed. PWR Core I was completely assembled and installed in the reactor vessel at Shippingport. The nuclear design work for the 16, 20, and 24 control rod cores under study was completed. Data from the completed analysis of the relative performance capability of rods, tubes, and plates in the blanket region of the core are given. Fission gas release from irradiated fuel elements was 3 to 5 times greater from elements containing diluted ceramic fuels than from elements containing UO_2. Additional corrosion, irradiation, and mechanical property data on the Ag–In–Cd alternate control rod alloy confirmed the suitability of this material for control rods. (M.H.R.)

3271 WAPD-P-388
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EFFECTIVENESS OF A CONTROL ROD–TWO-GROUP CELL THEORY. M. J. Galper. Jan. 18, 1954. Changed from OFFICIAL USE ONLY Sept. 10, 1957. 12p. $3.30 (ph OTS); $2.40(mf OTS).

The problem of determining the effectiveness of a central control rod in a cylindrical reactor was studied, and the diffusion equations, obtained on the basis of a two-group diffusion theory method, were solved. The results are obtained in the form of one three-by-three and one four-by-four determinant, suitable for solution by a desk calculator. (L.T.W.)

3272 WAPD-PWR-971
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SELECTION AND APPLICATION OF MATERIALS FOR THE PWR REACTOR PLANT. H. Mason. July 1957. 36p. Contract AT-11-1-GEN-14. $1.00(OTS).

Supplemental to WAPD-SC-541.

This report shows the approach taken in the selection of materials and the fabrication requirements imposed during the construction of the PWR plant. Many of the problems involved in the fabrication of nuclear components stem from safety considerations and the narrow margin for error in the selection and fabrication of materials subject to radioactivity. All of the known conditions which could lead to an unexpected and disastrous plant failure have been circumvented to the best of our present knowledge of materials and fabrication practices. All Commonwealth of Pennsylvania and ASME Codes for design, materials and fabrication have been met or exceeded throughout the design of the plant and its container. Above the design safety factors built into the plant are the strict material and fabrication requirements which are the best assurance that major ruptures will not occur in the PWR plant even under extreme accidental conditions of operation. (auth)

3273 WAPD-PWR-972
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHIPPINGPORT ATOMIC POWER STATION INSPECTION AND TEST PROGRAM. A. L. Bethel, W. H. Hirst, J. E. Nolan, and R[euel] F. Stratton. July 1957. 51p. Contract AT-11-1-GEN-14. $1.50(OTS).

Supplemental to WAPD-SC-541.

The Bettis Atomic Power Division and the Duquesne Light Company will conduct an inspection and test program which will cover all station material, equipment, and systems. This program will provide a means for checking the installation of material and equipment, will determine the adequacy of the test and operating procedures, and will check the operation of systems and equipment before and after reactor plant critical operations as well as providing essential performance data. All testing will be done in accordance with plant design, testing, and operating specifications. (auth)

3274 WAPD-PWR-Ph-106
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EXPERIMENTS WITH A WATER-REFLECTED SLAB CRITICAL ASSEMBLY. P. A. Rerko. May 1956. 22p. $4.80(ph OTS); $2.70(mf OTS).

3275 WAPD-PWR-RD-155
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CHOICE OF REFERENCE CONTROL ROD MECHANISM FOR PWR S.O. 1-AP-8002-C. N. J. Palladino. Feb. 21, 1956. Decl. Mar. 14, 1957. 6p. $1.80(ph OTS); $1.80 (mf OTS).

3276 WAPD-TM-50
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE EFFECT OF BUCKLING ON THE MULTIGROUP DIFFUSION THEORY GROUP CONSTANTS CALCULATED BY THE MUFT CODE. R. W. Wick. Nov. 1957. 37p. Contract AT-11-1-GEN-14. $1.00(OTS).

The concept of a few-group material buckling is reviewed, and the dependence of this quantity upon the assumed buckling of the multigroup Fourier transform slowing down calculation is discussed. The variation in material buckling as a function of the number of groups used in the few-group scheme is also discussed. The effects of the assumed MUFT buckling on k_∞, group ages, group diffusion constants, the spectrum of a critical bare core, and the group-dependent neutron leakage from a bare core are treated with specific examples. (D.E.B.)

3277 WAPD-TM-74
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ABSOLUTE POWER CALIBRATION OF A FLEXIBLE SURVEY ASSEMBLY. R. N. Olcott and D. Brown. Aug. 1957. 38p. Contract AT-11-1-GEN-14. $1.25(OTS).

By application of the standard Au foil technique, an absolute power calibration of 10.57 w ± 1.57% for a power level indicator of 7×10^{-9} log scale reading was obtained for a highly enriched Al–H_2O critical assembly. A detailed analysis of the various phases for this absolute power calibration is given so that such an experiment can be performed by any counting laboratory. (auth)

3278 WAPD-TM-83
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CALCULATION OF FISSION PRODUCT ACTIVITY IN PWR FROM A SEED PLATE FAILURE. P. W. Frank. Nov. 1957. 24p. Contract AT-11-1-GEN-14. $0.75(OTS).

Equations are developed to serve as a basis for the evaluation of the fission product problem associated with a cladding failure of a PWR seed plate. (W.L.H.)

3279 WCAP-277
Westinghouse Electric Corp. Atomic Power Div. and Pennsylvania Power and Light Co. Atomic Power Dept., Pittsburgh.
ESCAPE OF FISSION FRAGMENTS FROM SLURRY PARTICLES. C. J. McDole. July 23, 1956. 12p. $3.30 (ph OTS); $2.40(mf OTS).

Estimates are made, from other experimental data, of the ranges of fission fragments in ThO_2, H_2O, and D_2O. Calculations are then made, as a function of the diameter of spherical slurry particles, of the fraction of fission fragments escaping from the particles, the average value of the fraction of initial kinetic energy retained by the fission fragments after escape, the number that will strike a second slurry particle after escaping from the first, and

the amount of radiolytic gas that will be produced by the fission fragments, assuming no recombination. Calculations are also made of the effect of various types of radioactive decay on the escape of selected heavy nuclei from the slurry particles. (auth)

3280 WCAP-427

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Power Dept., Pittsburgh.

A METHOD FOR DETERMINING THE SETTLING RATE OF SLURRIES AT ELEVATED TEMPERATURES. G. Kivenson and W. E. Foster. Jan. 18, 1956. 25p. $4.80 (ph OTS); $2.70(mf OTS).

A method was developed for determining the settling rate of ThO_2-UO_2 slurries at 300°C and 1500 psig. The apparatus, consisting of a high pressure manometer and an autoclave, is simple and readily set up. The settling rates of mixed ThO_2-UO_2 slurries were measured at various temperatures. The settling rate was found to approach a maximum near 200°C. (auth)

3281 Y-F8-9(Del.)

Oak Ridge National Lab., Y-12 Area, Tenn.

CIRCULATING POTASSIUM HYDROXIDE REACTORS. C. S. Dauwalter and J. Y. Estabrook. Dec. 19, 1950. Decl. with deletions Feb. 21, 1957. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Interest in reactors cooled and moderated by KOH led to a fluid flow and thermodynamic study of such reactors. The results indicate the poor heat transfer properties of KOH would require a greater heat transfer area and a lower longitudinal temperature rise than is required with liquid alkali metal cooling. However, the dual role, coolant and moderator, of the hydroxide allows the calculation of reactors with small diameters, good moderator ratios, and reasonable pressure drops. (D.E.B.)

3282 Y-F10-68(Del.)

Oak Ridge National Lab., Y-12 Area, Tenn.

THE MULTIREGION REACTOR PROBLEM AS APPLIED TO THE MULTIGROUP METHOD. C. B. Mills. Aug. 16, 1951. Decl. with deletions Feb. 21, 1957. 5p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

3283

THE MERLIN RESEARCH REACTOR. Atomics 8, 431-2 (1957) Nov.

North-Rhine Westphalia is buying a medium flux research type of swimming pool reactor, "Merlin" type. The charge consists of 23 kg of U, enriched to 20% in U^{235} (M.H.R.)

3284

A LOW COST RESEARCH REACTOR. Atomics 8, 463-6 (1957) Dec.

The reactor is intended for work where a high thermal neutron flux is not necessary but low cost, maximum safety, and high sensitivity are required. (W.L.H.)

3285

NUCLEAR REACTORS IN FRANCE. J. Yvon. J. phys. radium 18, 545-51(1957) Oct. (In French)

The last general survey of the French nuclear reactors was given during the International Conference on "Pacific uses of atomic energy" (Geneva, 1955). In this paper a description is given of what has been done since this date, and what happened to the reactors in use. Thus it is in a way a kind of catalog which is presented. The author hopes nevertheless to give an idea, by pointing out the conspicuous facts, how the French plan, which is basically a plan for energy production, is being developed and where lie, in the field of atomic piles, the difficulties that do not allow overnight transformations of principles into realizations. (auth)

3286

ETR IN OPERATION. A.E.C.'S NEW TESTING REACTOR AT IDAHO FALLS. Nuclear Eng. 2, 476-80(1957) Nov.

A description is given of the Engineering Test Reactor which went critical in September 1957 at the National Reactor Testing Station at Idaho Falls. (W.L.H.)

3287

THE WORLD'S REACTORS. NO. 15. LIDO. Nuclear Eng. 2, 482a(1957) Nov.

3288

WINDSCALE. Nuclear Eng. 2, 510-12(1957) Dec.

As is generally known, the cause of the accident at Windscale on October 10 was the application of an excessive amount of nuclear heating during a release of Wigner energy, which caused an exceptional rise in temperature, leading to can failure, uranium oxidation, and finally a fire. Among the fission products released a certain amount of I^{131} passed through the stack filters in gaseous form. (auth)

3289

PLUTO. HARWELL'S SECOND HIGH-FLUX REACTOR. Nuclear Eng. 2, 513-14(1957) Dec.

Pluto is the second of Britain's three high-flux testing reactors. All three are intended for high-intensity irradiation, utilize highly enriched uranium fuel, and are moderated with heavy water. The differences of these three reactors are found in the arrangements for experimental facilities. The core of Pluto consists of a lattice of 26 elements arranged in rows of 4-6-6-6-4. Each of the fuel elements is made up of 10 curved plates of uranium–aluminum alloy clad in aluminum, with end fittings for forced circulation of heavy water. Control plates are of cadmium sheathed in stainless steel. The control plates provide coarse control. Fine control is provided by a Vernier rod moving vertically. Scram rods are provided which move vertically for emergency use. There is also a layer of heavy water above the core which acts as a reflector. The reactor is enclosed in an aluminum tank around which is a graphite reflector. The whole is enclosed in a double-skinned steel tank. The 4 in. space between the two skins is filled with lead with a cast-in cooling coil. Around this is the concrete biological shield. The entire reactor system operates in an inert atmosphere of helium. The building in which the reactor is housed is designed as a pressure shell. Pressure is normally kept slightly below atmospheric pressure to insure that any leak occurs inward. Pluto is intended for the irradiation of large loops and the production of Co^{60} at high activity levels. (A.C.)

3290

OMRE. Nuclear Eng. 2, 521-5(1957) Dec.

The Organic Moderated Reactor Experiment has been specifically designed to assist in solving the problems inherent in organic moderation and cooling of a power reactor by allowing additional information to be obtained on the stability and general behavior of hydrocarbons under operational conditions of temperature and radiation. It is located at the National Reactor Testing Station in Idaho. Plate-type fuel elements are used. The plates have an active area of 36 in. × 2½ in. and consist of a central element of fully enriched UO_2 with stainless steel cladding. It was estimated that 25 elements giving a total investment of 20.6 kg U^{235} would be required to provide sufficient excess reactivity to compensate for fuel burn-up, temperature effects, and xenon poisoning. Criticality was actually achieved with 20 elements. The control rods are steel tubes filled with compacted boron carbide powder. It was originally planned to operate the reactor on diphenyl on account of its low cost, commercial availability, and low melting point. The moderator actually selected, however, was a mixture known by its trade name of Santowax O.M.,

consisting of a mixture of ortho- and meta-terphenyl, with small amounts of diphenyl and para-terphenyl, with the consistency of a thick slurry almost solid at room temperature, but completely liquid slightly below 200°F. OMRE is expected to provide a considerable amount of information which cannot be obtained from capsule irradiation or in-pile loop experiments, the most important being the rate of decomposition or damage, the effect of this damage on the operation of the reactor, and the requirements for successful operation in spite of this damage. It should be emphasized that the main object of OMRE is to conduct experiments upon the moderator, and treatment of spent fuel elements is a secondary consideration. (A.C.)

3291

MOLTEN FLUORIDES AS POWER REACTOR FUELS. R. C. Briant and Alvin M. Weinberg (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 797-803(1957) Nov.

Molten fluorides of uranium, thorium, plutonium, and other elements potentially have wide applicability as fuels for power reactors. Because of their low vapor pressure they can be used in very high-temperature but low-pressure liquid-fuel reactors. In addition, they possess great chemical flexibility—the molten-salt principle can be applied to burners, thorium-uranium thermal breeders, plutonium-uranium converters, and possibly even to fast plutonium breeders. Because of the very high thermal efficiency obtainable in reactors using molten salt fuel, the fuel cost in a simple burner using enriched U^{235} is of the order of 2 to 3 mills/kwhr. A high-temperature reactor using molten uranium salts (Aircraft Reactor Experiment) was operated for a short time at the Oak Ridge National Laboratory. The reactor was of the circulating-fuel type, with a BeO moderator. The maximum outlet temperature achieved was greater than 1500°F. It is believed that with further development the ARE could be a prototype for an economical uranium burner. (auth)

3292

THE AIRCRAFT REACTOR EXPERIMENT. DESIGN AND CONSTRUCTION. E. S. Bettis, R. W. Schroeder, G. A. Cristy, H. W. Savage, R. G. Affel, and L. F. Hemphill (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 804-25(1957) Nov.

The Aircraft Reactor Experiment was designed for operation at temperatures in the region of 1500°F at a power of 1 to 3 Mw with a fluoride-salt fuel circulating in a heterogeneous core. The moderator was hot-pressed BeO blocks cooled by circulating sodium. The heat produced was dissipated in water through hot liquid-to-helium-to-water heat exchange systems. All sodium and fuel circuit components were made of Inconel fabricated by inert-gas (Heliarc) welding. The system was heated to design temperature by means of electrical heating units applied over all parts of the system. Instrumentation and control of the experiment were fairly conventional. For the most part, standard instruments were modified slightly for the high-temperature application. The reactor system was constructed and operated in a building specifically provided for the purpose. (auth)

3293

THE AIRCRAFT REACTOR EXPERIMENT. PHYSICS. W. K. Ergen, A. D. Callihan, C. B. Mills, and Dunlap Scott (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 826-40(1957) Nov.

The fluoride of a fissionable material dissolved in molten fluorides of other cations can serve as the fuel of a circulating-fuel nuclear reactor. These fluorides have a slowing-down power about one-half or one-fourth of the slowing-down power of dense graphite. The resonance escape probability depends strongly on the cation but is always less than that of carbon. The consequences of these properties for various reactor applications are discussed. Techniques for critical experiments for molten fluoride reactors have been developed, and the physics aspects of operation of the ARE have been analyzed. Operation of the ARE demonstrated that molten-fluoride reactors have strong negative temperature coefficients, mainly as a result of fuel expansion. The ARE was shown to be very stable and to be a slave to the power load. No Xe^{135} poisoning was found in the ARE, and the radioactivity of the fuel after removal from the reactor was less than it would have been if all fission fragments had been retained. The loss of delayed neutrons by fuel circulation modified the inhour equation but not the stability of the ARE. (auth)

3294

THE AIRCRAFT REACTOR EXPERIMENT. OPERATION. E. S. Bettis, W. B. Cottrell, E. R. Mann, J. L. Meem, and G. D. Whitman (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 841-53(1957) Nov.

The ARE was operated successfully in November, 1954, at various power levels up to 2.5 Mw. The maximum steady-state fuel temperature was 1580°F, and there was a differential temperature between the inlet and outlet in the $NaF-ZrF_4-UF_4$ fuel of 355°F. The fuel system was in operation for 241 hr before the reactor first became critical and the nuclear operation extended over a period of 221 hr. The final 74 hr of operation were in the megawatt range and resulted in the production of 96-Mwhr of nuclear energy. Effects of various transient conditions on reactor operation were determined. (auth)

3295

EVALUATION OF A HOMOGENEOUS REACTOR. Nucleonics 15, No. 10, 64-71(1957) Oct.

A study team consisting of scientists and engineers from Babcock and Wilcox Co. and the Nuclear Power Group of midwestern utilities worked out the complete design for a 150,000-kw nuclear power station and then went on to make a detailed analysis of the total cost of power produced by this facility. The reactor decided on was a single-fluid aqueous homogeneous two-region breeder that operates on the $Th-U^{233}$ cycle. (L.T.W.)

3296

CALCULATING GAMMA HEATING IN REACTOR STRUCTURES. H. C. Claiborne, C. M. Copenhaver, H. W. Bertini, and T. B. Fowler (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 10, 114-21(1957) Oct.

3297

MEASURING THE PROMPT PERIOD OF A REACTOR. G. S. Brunson, R. Curran, S. G. Kaufmann, J. McMahon, and L. Pahis (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 11, 132-4, 136, 138, 140-1(1957) Nov.

The method described, the Rossi alpha method, arrives at the prompt period through statistical observations of the neutron population while the reactor is in a delayed critical or subcritical condition. In addition the method yields information about over-all reactor behavior and permits control-rod evaluation directly in dollars. (L.T.W.)

3298

EFFECTIVENESS OF CONTROL-ROD MATERIALS. H. P. Iskenderian (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 11, 150-4(1957) Nov.

Formulas are derived which allow quantitative estimates of the relative effectiveness of different materials in a thermal reactor as a function of thickness and neutron energy spectrum. (L.T.W.)

3299

SWEDISH POWER REACTOR PROPOSAL. Ragnar Liljeblad. Nucleonics 15, No. 11, 165-9(1957) Nov.

The proposed Swedish 444-Mw gas-cooled power reactor is described. (L.T.W.)

3300

STARTING UP SRE. Frank E. Faris (Atomics International, Canoga Park, Calif.). Nucleonics 15, No. 12, 37-40 (1957) Dec.

Early low power operation of the Sodium Reactor Experiment has gone well. Lessons learned from planned experiments and a fuel-loading incident are being applied. (L.T.W.)

3301

REMOTE FUEL FABRICATION. HOW IT WAS DONE FOR EBR-II. Arthur S. Shuck (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 12, 50-3(1957) Dec.

Remote refabrication of irradiated fuel might lower fuel-recycling costs by permitting shorter cooling periods and simple reprocessing. Such a fabrication system was designed and engineered for EBR-II. (L.T.W.)

3302

FISSION-PRODUCT MONITORING IN REACTOR COOLANT WATER. R. L. Heath (Phillips Petroleum Co., Idaho Falls, Idaho). Nucleonics 15, No. 12, 54-8(1957) Dec.

At the Materials Testing Reactor burst fuel elements are detected by recognizing fission-product iodine. Filtering through a cation resin and low-energy gamma discrimination makes the test specific for iodine isotopes. (L.T.W.)

3303

REACTOR WATER PROCESSING: HOW IT IS DONE IN APPR. A. Louis Medin (ALCO Products, Inc., Schenectady, N. Y.). Nucleonics 15, No. 12, 72, 74, 76, 78, 80-1(1957) Dec.

The water treatment facilities provided for the Army Package Power Reactor (APPR) are described. Although the APPR is a relatively small pressurized-water reactor, the water treatment problems of larger commercial power reactors should be similar. (L.T.W.)

3304

ROD DRIVES FOR WATER REACTORS. Nucleonics 15, No. 12, 82-5(1957) Dec.

In water-moderated and -cooled reactors such as pressurized-water and boiling reactors, the control rod drives must perform satisfactorily under various temperature and pressure conditions in an environment of hot water or steam. The main problems in designing these drives are corrosion, sealing, and fast insertion (scram). (L.T.W.)

3305

REACTORS ON THE LINE. SODIUM REACTOR EXPERIMENT. Nucleonics 15, No. 12, 36a-b(1957) Dec.

The Sodium Reactor Experiment is a thermal, sodium-cooled reactor using graphite as the moderator and slightly enriched uranium as the fuel. A description of the reactor is given, and its characteristics are listed. (L.T.W.)

3306

BASIC PROBLEMS IN NUCLEAR POWER PRODUCTION. Waclaw Frankowski. Nukleonika, 2, No. 2, 225-65(1957). (In Polish)

A survey is given of the economic aspects of nuclear power production. The selection of fuels, the coefficient of transformation, the fuel cycles, the performance curve (of U^{235}, Pu^{239}), and various types of reactors were analyzed. Estimates were made of the production and demand of fissionable materials, the value of Pu from early power stations, and costs of nuclear fuels. (R.V.J.)

3307

THEORY OF HETEROGENEOUS REACTORS. PART I. PLANE REGULAR LAMINATED PILE. Kurt Meetz. Z. Naturforsch. 12a, 698-709(1957) Sept. (In German)

Nuclear Transformation

3308 UCRL-8020

California. Univ., Berkeley. Radiation Lab.

NUCLEAR REACTIONS OF URANIUM INDUCED BY 5.7-Bev PROTONS; RADIOCHEMICAL YIELDS OF LIGHT ELEMENTS. Chalon Lucius Carnahan. (Thesis). Oct. 1957. 33p. Contract W-7405-Eng-48. $1.00(OTS).

Uranium was bombarded with 5.7-Bev protons. Formation cross sections are reported for products in the mass region $7 < A < 66$. The peak yields for each mass number were found to occur along the stability line or slightly to the neutron-excess side of it. The data fit in well with current ideas concerning processes involved in high-energy nuclear reactions. (auth)

3309

PRELIMINARY EXPERIMENTS ON RADIOACTIVITIES CONSEQUENT TO THE EXPLOSION OF WIRES CONTAINING DEUTERIUM. M. Bonpas, A. Ertaud, J. P. Legrand, and R. Meunier. J. phys. radium 18, 595-92 (1957) Oct. (In French)

In preliminary experiments made in 1952-1953, studying high temperature production processes, thin wires were exploded by means of electrical discharges. The neutron emission produced during the explosion was measured by manganese activation. Following the discharge, in the vicinity of the electrodes supporting the wire, a radioactivity was found which decomposed in two periods: 38 ± 1 min, and 5 ± 1 min. These two periods can be assigned respectively to Zn^{63} and Cu^{66} produced from the brass of the electrodes. If it seems experimentally well established that nuclear reactions have been produced, their interpretation is however rather uncertain. (auth)

3310

STUDY OF THE B^{11} + p REACTIONS. G. Dearnaley, G. A. Dissanaike, A. P. French, and G. Lindsay Jones (Cavendish Lab., Cambridge, Eng.). Phys. Rev. 108, 743-53(1957) Nov. 1.

This paper describes a detailed study of the $B^{11}(p,\alpha_0)Be^8$, $B^{11}(p,\alpha_1)Be^{8*}$ $(2\alpha_2)$, and $B^{11}(p,p)$ processes for the region of proton energies spanning the resonances at 0.67 Mev and 1.4 Mev. The measurements include excitation functions and angular distributions, together with the angular correlation between α_1 and α_2 as inferred from the alpha-particle energy spectrum in fixed geometry. The results are analyzed theoretically and are discussed in relation to the findings of other investigators. It is concluded that the complete body of data can be accounted for if the 0.67-Mev resonance (16.57-Mev state of C^{12}) is (2−) and the 1.4-Mev resonance (17.22-Mev state of C^{12}) is (1−), both formed mainly by s-wave protons; this would corroborate the preferred assignments previously suggested. The proton elastic scattering data imply that the ratio Γ_p/Γ is 0.5 for the 0.67-Mev resonance and 0.05 for the 1.4-Mev resonance. (auth)

3311

EXPERIMENTAL SURVEY OF NUCLEAR TRANSFORMATIONS CAUSED BY 2-Mev LITHIUM IONS. E. Norbeck, Jr. and C. S. Littlejohn (Univ. of Chicago, Ill.). Phys. Rev. 108, 754-9(1957) Nov. 1.

Ion beams of Li^7 or Li^6, between 1 and 2 Mev in kinetic energy, produced in a Van de Graaff accelerator were used to bombard targets containing light elements and some of the induced nuclear reaction products were detected. Detection was by observation of the induced radioactivity, or by counting charged particles, or by activation of copper by means of the fast neutrons produced. Existence of the following reactions were demonstrated:

Target	Beam	Products
Li^6	Li^6	$C^{11} + n$; $He^5 + Be^7$
Li^6	Li^7	$C^{11} + 2n$; $B^{12} + p$; $C^{12} + n$
Li^7	Li^7	$B^{12} + p$; $B^{12} + d$; $Be^9 + He^6$; $C^{13} + n$
Be^9	Li^6	$N^{13} + 2n$; $N^{14} + n$
Be^9	Li^7	$B^{12} + He^4$; $Be^8 + Li^8$; $N^{15} + n$
B^{10}	Li^6	$O^{15} + n$; $O^{14} + 2n$; $C^{11} + He^5$
B^{10}	Li^7	$O^{15} + 2n$
C^{12}	Li^6	$F^{17} + n$
C^{12}	Li^7	$F^{18} + n$

Yield vs. bombarding-energy curves were obtained for the Li–Li reactions and the Be^9 reaction producing Li^8. Resonances in the yield were not observed. Some of the reactions are capable of producing neutrons of 20-Mev energy; the existence of neutrons above 11 Mev was demonstrated by initiating the reaction $Cu^{63}(n,2n)Cu^{62}$, which requires this energy. A search for the production of N^{13} from the reaction $B^{10}(Li^7, H^4)N^{13}$ through the range of bombarding energy indicated by the mass range through which H^4 would be stable against heavy-particle breakup gave a null result, indicating that H^4 is unstable. Estimates for the yield at 2-Mev bombarding energy were made for all reactions except that leading to F^{17}. (auth)

3312

COINCIDENCE STUDIES OF THE $Ni^{58}(p,2p)$ REACTION. Bernard L. Cohen (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 768-73(1957) Nov. 1.

The $Ni^{58}(p,2p)$ reaction, by far the predominant reaction in that nucleus, was studied by detecting the two outgoing protons in coincidence. Measurements were made of the energy spectra of all protons from the reaction, of the spectrum of the sum of the energies of the two outgoing protons, and of the angular correlations of the outgoing protons with each other and with the incident proton. The results indicate quite conclusively that the preponderance of (p,2p) over (p,pn) reactions in Ni^{58} is not due to the relative level densities of the final nuclei, the ineffectiveness of Coulomb barriers, or a high emission energy of the "first" proton leaving emission of a neutron energetically forbidden. Other possible explanations are considered. There is strong evidence that the (p,2p) reaction mechanism is predominantly a direct one in which the two protons are "knocked-out" simultaneously. (auth)

3313

(n,p) REACTIONS IN Mg, Ni, Cu, Rh, AND Pd AT 14 Mev. V. V. Verbinski, T. Hurlimann, W. E. Stephens, and E. J. Winhold (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 108, 779-82(1957) Nov. 1.

Emitted protons were observed from foils of Mg, Ni, Cu, Rh, and Pd bombarded with 14-Mev neutrons. Measurements were made of cross sections and energy and angular distributions for protons of energies greater than 5 Mev. The results indicate that a relatively direct interaction between incident neutron and emitted proton is an important process in (n,p) reactions in medium-weight nuclei. (auth)

3314

STRIPPING-TYPE NUCLEAR REACTIONS. Thomas Fulton and George E. Owen (Johns Hopkins Univ., Baltimore, Md.). Phys. Rev. 108, 789-94(1957) Nov. 1.

An exact formal expression is derived which treats the initial and final states of a nuclear reaction in a symmetric manner. The specific example treated is the (d,n) reaction. The Coulomb interaction is not taken into account. Estimates of some of the terms of the general expression which is obtained provide some indication of the reasons for the similarity of the final results of the various approaches to direct interaction. One of the terms of the development includes effects of compound-nucleus formation. Suggestions are made for a single-particle model of the intermediate state. The process of exchange and heavy-particle stripping is incorporated into the formalism in the Appendix. (auth)

3315

REACTIONS $Al^{27}(\alpha,p)Si^{30}$ AND $P^{31}(\alpha,p)S^{34}$ AT 30.5 Mev. C. E. Hunting and N. S. Wall (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 901-3(1957) Nov. 1.

3316

FURTHER INVESTIGATION OF $N^{15} + p$ REACTIONS. F. B. Hagedorn and J. B. Marion (California Inst. of Tech., Pasadena). Phys. Rev. 108, 1015-19(1957) Nov. 15.

Excitation functions at nine angles for the reaction $N^{15}(p,\alpha_0)C^{12}$ are reported for incident proton energies from 0.9 to 1.3 Mev. At a laboratory angle of 140° the excitation function has been extended to 2.9 Mev. In addition to previously reported resonances near 1.03 and 1.21 Mev, corresponding to O^{16} states at 13.08 and 13.24 Mev, an anomalous behavior is observed near 1.87 Mev. Additional evidence for such behavior near this energy has been obtained from the $N^{15}(p,\alpha_{1\gamma})C^{12}$ reaction. The qualitative features of the $N^{15}(p,\alpha_0)C^{12}$ data are shown to be consistent with the assignments $J = 1^-$, $J = 1^-$, and $J = 3^-$ for the 0.34, 1.03, and 1.21-Mev resonances, respectively. Fitting Breit-Wigner curves to the measured excitation function of $N^{15}(p,\alpha_{1\gamma})C^{12}$ near 1.64 and 1.98 Mev has yielded $E_R = 1.640 \pm 0.003$ Mev ($\Gamma = 68 \pm 3$ kev) and $E_R = 1.979 \pm 0.003$ Mev ($\Gamma = 23 \pm 2$ kev) for these previously reported resonances (O^{16} states at 13.65 and 13.97 Mev). It is shown that $\Gamma_p/\Gamma \ll 1$ for the resonance at 1.98 Mev. (auth)

3317

REACTIONS $Li^7(\alpha,n)B^{10}$, $Li^7(\alpha,\alpha')Li^{7*}$, AND $B^{10}(n,\alpha)Li^7$. Hans Bichsel and T. W. Bonner (Rice Inst., Houston, Texas). Phys. Rev. 108, 1025-7(1957) Nov. 15.

The nuclear reactions $Li^7(\alpha,n)B^{10}$ and $Li^7(\alpha,\alpha')Li^{7*}$ have been studied for monoenergetic α particles from a Van de Graaff accelerator. The threshold in the (α,n) reaction was measured to be 4.379 Mev which gives a Q value of −2.788 Mev. Resonances in the yield of 0.477-Mev γ radiation were observed at α-particle energies of 1.91, 2.49, 3.06, 3.6, 4.39, 4.6, and 5.0 Mev. The inverse reaction $B^{10}(n,\alpha)Li^7$ was also studied by using monoenergetic neutrons with energies between 0.020 and 4.80 Mev. Resonances were observed at neutron energies of 0.53, 1.86, 2.8, and 4.1 Mev. Excited states in B^{11} from these experiments are indicated at 9.88, 10.25, 10.62, 10.97, 11.46, 11.6, 11.9, 13.2, 14.0, and 15.2 Mev. (auth)

3318

EXCITATION FUNCTIONS UP TO 980 Mev FOR PROTON-INDUCED REACTIONS IN SOME LIGHT ELEMENTS. J. L. Symonds, J. Warren, and J. D. Young (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) A70, 824-32 (1957) Nov.

A study has been made of some of the active products from the high energy bombardment of C, N, O, and F. The ratios of cross sections to the $C^{12}(p,pn)C^{11}$ cross section were found and the excitation functions estimated. Deviations from a monotonic decrease of cross section with energy for some reactions have been found and are discussed. Evidence exists for a marked dependence of the (p,pn) cross section on the energy level structure of the residual nucleus. (auth)

3319

THE INTEGRATED CROSS SECTION FROM THRESHOLD TO 30 Mev FOR THE REACTION $^9Be(\gamma,2n)^7Be$. K. H. Lokan (Australian National Univ., Canberra). Proc. Phys. Soc. (London) A70, 836-8(1957) Nov.

In an attempt to estimate the $Be^9(\gamma,2n)Be^7$ cross section,

a measurement was made with the 30 Mev Canberra Synchrotron. A figure for yield of Be^7 per Cu disintegration was obtained. Knowledge of the (γ,n) cross section for Cu, and of the bremsstrahlung distribution for the machine, together with an assumption of a reasonable shape for the excitation function for the reaction, then leads directly to an estimate of the integrated cross section. The value from threshold to 30 Mev is $\int_{20.56}^{30} \sigma\,(E)dE = (1.2 \pm 0.2)$ Mev mbn. (M.H.R.)

3320

GAMMA QUANTA EMITTED BY I, Rh AND Co NUCLEI IN THERMAL NEUTRON CAPTURE. I. V. Estulin, L. F. Kalinkin, and A. S. Melioranskii (Moscow State Univ.). Soviet Phys. JETP 4, 752-4(1957) June.

3321

THE EFFECT OF FINITENESS OF TARGET-NUCLEUS MASS ON ANGULAR DISTRIBUTION IN (d, p) AND (d, n) REACTIONS. D. P. Grechukhin. Soviet Phys. JETP 4, 759-61(1957) June.

3322

YIELD OF CALIFORNIUM ISOTOPES PRODUCED IN THE INTERACTION BETWEEN CARBON IONS AND URANIUM NUCLEI. Yu. B. Gerlit, L. I. Guseva, et al. (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 339-42 (1957) Aug. (In Russian)

The yield of the californium isotopes Cf^{246}, Cf^{245}, and Cf^{244} produced in the reaction between 90-Mev carbon ions and a thick uranium target was investigated. The absolute californium yield per incident particle is $1.5 \cdot 10^{-9}$ Cf^{246} nuclei, $\sim 3.0 \cdot 10^{-9}$ Cf^{245} nuclei, and $9 \cdot 10^{-11}$ Cf^{244} nuclei. Comparison of the obtained results with the cross section for fission of uranium by carbon ions indicates that fission is $3.8 \cdot 10^3$ times more probable in this case than neutron evaporation from the compound Cf^{250} nucleus. (tr-auth)

3323

ON THE CROSS SECTION FOR PRODUCTION OF MULTIPLY CHARGED PARTICLES IN THE INTERACTION BETWEEN PROTONS AND NUCLEI. O. V. Lozhkin (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 354-7(1957) Aug. (In Russian)

Nuclear emulsions were used to study the bombarding proton energy and atomic weight dependence of the cross section for production of multiply charged ($Z \geq 4$) particles in nuclear disintegrations due to fast protons. The cross section for production of particles possessing an energy greater than 1 or 2 Mev per nucleon varies from 3 to 12×10^{-27} cm^2 for incident particle energies lying between 300 to 660 Mev if heavy nuclei (Ag, Br) are disintegrated and remains equal to 2×10^{-27} cm^2 if light nuclei (C, N, O) are disintegrated. For a given energy of the incident particles the cross section of the reaction increases with increase of the mass number of the target nuclei. (tr-auth)

3324

EFFECTIVE CROSS SECTION OF THE REACTION (n,2n) ON Be^9. S. S. Vasil'ev, V. V. Komarov, and A. M. Popova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 527-8(1957) Aug. (In Russian)

Effective cross sections of the reaction (n,2n) on Be^9 were measured, and cross sections of competing reactions $Be^9(n,\alpha)He^6$ and $Be^9(n,t)Li^7$ have been found. (R.V.J.)

3325

STRIPPING REACTION IN THE INTERACTION OF ACCELERATED NITROGEN IONS N^{14} WITH THE NUCLEI OF SOME ELEMENTS. V. V. Volkov, A. S. Pasyuk, and G. N. Flerov (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 595-601(1957) Sept. (In Russian)

The formation of the radioactive isotope N^{13} was observed when ~100 Mev cyclotron accelerated nitrogen ions N^{14} bombarded foils of Al, Ni, Cu, Ag, Sn, and Cd. Measurements of the angular distribution showed that the N^{13} nuclei are emitted in a comparatively narrow angle range. The angle corresponding to maximal intensity increases with Z. If the energy or the bombarding particle exceeds the height of the Coulomb barrier the effective cross section for production of N^{13} will weakly depend on the energy. The cross section is equal to ~30 mb for Ni and ~12 mb for Al. (tr-auth)

3326

ON THE NUCLEAR REACTION $Li^6(nt)He^4$. T. I. Kopaleishvilli (Tbilisi State Univ., U.S.S.R.). Zhur. Eksptl' i Teoret. Fiz. 33, 788-9(1957) Sept. (In Russian)

The energy dependence of the $Li^6(nt)He^4$ reaction cross section was investigated. (R.V.J.)

Particle Accelerators

3327 AERE-T/R-2342

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

COUPLED MOTION IN THE SPIRAL RIDGE CYCLOTRON. J. W. Burren, N. M. King, and W. Walkinshaw. Aug. 1957. 51p.

The coupled dynamics is examined analytically and computationally, with particular reference to the proposed conversion of the Harwell synchrocyclotron, (N = 4). Effects due to the $2Q_v = Q_R$ resonance and higher-order coupled instabilities are observed, theory and computation being in excellent agreement. Two high-order resonances, $2Q_v = 4 - 3Q_R$, and $2Q_v = 4\ (Q_R - 1)$, are significant in the proposed design, the former being the more serious. These studies provide a realistic assessment of the design, the chief conclusion being that radial betatron oscillation amplitudes must be kept within about $\frac{1}{2}$ in., due to vertical build-up in crossing the $2Q_v = 4 - 3Q_R$ resonance. The results do not preclude the choice of a linear spiral law, $\theta = \alpha r_\theta$, for the ridges, and indicate that α should be about 0.1 radians/in. (auth)

3328 ANL-5803

Argonne National Lab., Lemont, Ill.

PARTICLE ACCELERATOR DIVISION SUMMARY REPORT [FOR] APRIL THROUGH SEPTEMBER 1957. Oct. 1957. 68p. Contract W-31-109-Eng-38. $2.00(OTS).

Abstracts of published reports and a list of the internal memos of general interest are included. The radial variation of magnetic field as a function of the magnitude of the central field was measured and investigated with model magnets. Measurements on end-effects were made on the $\frac{1}{7}$-scale model magnet. The calculated and measured fields at the ramp end are shown for a low field value where there is no saturation and such calculations are expected to be valid. The variation in the effective magnetic end position as a function of the central field value and also the radial shape of the effective end as a function of central field value are shown. Flow measurements were made for the various sizes of Cu tubing that could be used for model magnet coils. A block diagram of a new generator regulator for the G. E. generator is given. A schematic diagram of the pulse circuit for the $\frac{1}{4}$-scale model magnet and an idealized voltage waveform on an inductive load are shown. A plan view of the ring magnet is given showing the basic dimensions and a proposed arrangement of the various basic components which will occupy the straight sections. A plan view of a magnet octant is sketched showing how piles may be conveniently driven to form a pile bent. The pile bent spacing dimensions and bent loadings are given when

deflections at the overhanging ends and at all the midpoints of the spans are equal. The results of the calculations of the magnetization of the magnet of the 12.5 Bev proton synchrotron are tabulated and graphed. The schematic circuit of the master oscillator r-f control system is given. The bias program which must be developed and the various contributions which are added together to get it are plotted. Results are given on Evapor-ion pump speed using nitrogen and air. Pump-down data for air in a 23-ft stainless steel chamber with an Evapor-ion pump are tabulated. (For preceding period see ANL-5713.) (M.H.R.)

3329 LWS-12400(Del.)

California Research and Development Co., Livermore, Calif. and California. Univ., [Livermore]. Radiation Lab.

EVALUATION OF RADIOLOGICAL HAZARDS TO THE PUBLIC FROM THE OPERATION OF A-12. Mar. 1952. Decl. with deletions Feb. 28, 1957. 173p. $28.80(ph OTS); $8.40(mf OTS).

With this are bound: Saint Louis Univ. Inst. of Tech. A REPORT ON THE SEISMICITY OF THE WELDON SPRINGS AREA. James B. Macelwane; Weather Bureau, Washington, D. C. EXPECTED METEOROLOGICAL CONDITIONS FOR THE WELDON SPRING SITE OF THE ATOMIC ENERGY COMMISSION. Nov. 1951; and Geological Survey. PRELIMINARY INVESTIGATION OF GROUND WATER OCCURRENCES IN THE WELDON SPRING AREA, ST. CHARLES COUNTY, MISSOURI. Claude M. Roberts. With FURTHER NOTES ON PROBLEMS OF THE WELDON SPRING AREA, MISSOURI. C. V. Theis. Dec. 1951.

This report describes and evaluates potential public hazards which could result from the operation of the Materials Testing Accelerator A-12 installation at the Weldon Spring, Missouri site. The A-12 installation evaluated produces 467 kilograms/yr of plutonium by utilizing a 500 ma continuous wave beam of 350 Mev deuterons from the linear accelerator and a target and lattice assembly containing fuel with water cooling and moderation. This machine is not a reactor and cannot under any circumstances become critical and run away. Public hazards are evaluated on the basis of probability of the accident and the severity of the resultant hazard. The probability of a major public hazard is believed to be practically zero. Calculations indicate that total loss of coolant to the primary target and the rupture of a high-level waste storage tank would have higher severity than other accidents discussed. The effects on the public of these two hazards are analyzed numerically as examples of maximum public hazards and if they were to occur they are shown to be serious but not catastrophic. (auth)

3330 MURA-374

Midwestern Universities Research Assn., Madison, Wis.

QUARTERLY REPORT TO THE ATOMIC ENERGY COMMISSION FOR THE PERIOD JULY 1, 1957 TO SEPTEMBER 30, 1957. Oct. 1, 1957. 8p. Contract [AT(11-1)-384]. $0.50(OTS).

3331 MURA-376

Midwestern Universities Research Assn., Madison, Wis.

THE RADIATION ENERGY LOSS IN A FIXED FIELD ACCELERATOR. G. Parzen. Nov. 14, 1957. 11p. Contract AT(11-1)-384. $3.30(ph OTS); $2.40(mf OTS).

The radiation loss per turn is calculated for the general spiral sector and radial sector FFAG accelerators. (auth)

3332 NRL-4993

Naval Research Lab., Washington, D. C.

REVISED PROPOSAL FOR INVESTIGATION OF SELF-FOCUSING STREAMS. Willard H. Bennett. July 19, 1957. 16p.

A method is proposed for producing sustained self-focusing streams of relativistic electrons in a closed loop. Electrons from an electron linear accelerator are injected at full energy into a magnetic guide-field similar in form to that of a cyclotron. The electrons injected in each pulse are held by an increase in guide-field lasting long enough for the electrons to radiate energy and shrink in loop radius too much to escape. By successive injections of electrons, the cycling current is built up to the minimum critical value for self-focusing and held there. The objective is to study the physical characteristics of self-focusing streams in order to exploit their peculiar properties. (auth)

3333 USNRDL-TR-129

Naval Radiological Defense Lab., San Francisco.

NEUTRON BEAM CHARACTERISTICS FROM THE UNIVERSITY OF CALIFORNIA 60-IN. CYCLOTRON. E. Tochilin and G. D. Kohler. Jan. 9, 1957. 22p. Project NB-081-001.

Physical measurements of the neutron beams obtained by bombarding a thick Be target with 24-Mev deuterons and 12-Mev protons included a determination of fast neutron flux with S threshold detectors and of spectrum with nuclear track plates. On the basis of these measurements the first collision neutron dose was computed. Comparisons were made with other calibrated neutron sources of similar spectra. The γ-ray dose associated with the neutron beam was determined by means of photographic emulsion techniques. (auth)

3334

PRETHERAPEUTIC STUDIES WITH THE CHICAGO SYNCHROCYCLOTRON. S. D. Warshaw and D. G. Oldfield (Univ. of Chicago, Ill.). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 876-86(1957) Nov.

3335

CONSTRUCTION OF AN ELECTROSTATIC ACCELERATOR FOR 2 MV AFTER VAN DE GRAAFF. E. Cilenšek and A. Pečnikar. "J. Stefan" Inst. Repts. (Ljubljana) 2, 21-6(1955) May.

An electrostatic accelerator is in construction for a tension of 2 Mv and a charging current of 1200 μa. It will be closed in a tank and work at an air pressure of 10 at. The ion source for the accelerator is one of a simple radiofrequency type with a frequency of 80 Mc. So far the transport of the charge on the open accelerator has been tested and a charging current of 200 μa has been obtained. (auth)

3336

THE 31 Mev-BETATRON. A. Peterlin. "J. Stefan" Inst. Repts. (Ljubljana) 2, 53-9(1955) May. (In German)

3337

LINEAR ACCELERATORS AS RADIOISOTOPE PRODUCERS. Malcolm H. MacGregor (Applied Radiation Corp., Walnut Creek, Calif.). Nucleonics 15, No. 11, 176-80 (1957) Nov.

3338

PARTICLE ACCELERATORS. Wlodzimiez Zych. (Inst. of Nuclear Research, Warsaw.) Nukleonika 2, No. 2, 267-230(1957). (In Polish)

General descriptions are given of various high-energy accelerators and their application in physics research work. The design and performance of cyclotrons, electromagnetic synchrotrons, synchrocyclotrones, synchrophasatrons (betatron), and cosmotrons are discussed. (R.V.J.)

3339

FOCUSING PROCEDURES FOR ELECTROSTATIC ACCELERATORS. C. H. Johnson, J. P. Judish, and C. W.

Snyder (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 28, 942-8(1957) Nov.

Ion optics for Van de Graaff accelerators are reviewed in elementary terms of geometric optics with particular reference to the Oak Ridge 3-Mv accelerator. This machine produces well-focused beams of over 100 μa and pulsed peak currents of several hundred μa. The beam diameter measured at a distance of 2.7 tube lengths from the accelerator tube exit decreased from 0.26 in. at 0.38 Mv to 0.10 in. at 2.47 Mv. The beam divergence at 1.8 tube lengths from the exit is nearly constant, $\simeq 2.8 \times 10^{-3}$ rad. The system is analyzed in terms of five separate lenses: (1) einzel lens, (2) gap lens, (3) accelerator tube, (4) 90-degree analyzing magnet, and (5) strong-focusing lens. It is shown that the crossovers formed in the gap lens and near the exit of the analyzing magnet are of fundamental importance. Brief reference is made to the small energy spread, $\simeq 0.025\%$, for the beams obtained from this accelerator in spite of the large control slit spacing demanded by a large crossover. (auth)

3340

SYNCHROTRON OSCILLATIONS IN STRONG FOCUSING ACCELERATORS. I. LINEAR THEORY. L. L. Gol'din and D. G. Koshkarev. Soviet Phys. JETP 4, 681-90(1957) June.

The equations which describe synchrotron oscillations in strong focusing accelerators are examined, taking into account the relations between the field and the frequency. A general solution is found which describes the oscillations both in the adiabatic and in the critical region and the corresponding integrals of motion are obtained. It is shown that the motion in the critical region can be simply described by means of the "effective frequency" of the oscillations. The effect of fluctuations of the radio frequency, of the accelerating voltage and of the magnetic field is considered, along with the question of the influence of noises on the synchrotron oscillations. The transition through the critical point is studied. The computations are carried to the point of the derived formulas which determine the tolerances for the corresponding fluctuations. (auth)

Radiation Absorption and Scattering

3341 JENER-53

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

SPIN FLUCTUATION SCATTERING OF NEUTRONS IN MAGNETITE. T. Riste and J. Janik. Nov. 1957. 19p.

Observations on the diffuse peaks of inelastically scattered neutrons in Fe_3O_4 at room temperature are found to give values of peak widths and total cross sections consistent with the theory of neutron scattering by spin waves. The lack of influence of technical magnetic fields on the diffuse component is explained by the low intrinsic susceptibility of the magnetic domains. The widths of the peaks observed give a value of the exchange integral J_{AB} of 6.10^{-4}ev and indicate that the proper dispersion law for spin waves in ferrites is quadratic. (auth)

3342

INELASTIC SCATTERING OF FAST NUCLEONS BY LIGHT NUCLEI. INFLUENCE OF THE COMPLEX POTENTIAL. Pierrette Benoist, Claude Marty, and Philippe Meyer. Compt. rend. 245, 1389-91(1957) Oct. 21. (In French)

3343

GAMMA RAY SPECTRUM DUE TO THE INELASTIC SCATTERING OF 2.5 Mev NEUTRONS IN IRON. Philippe Éberhard, Jagadish Garg, and Bèchir Torki. Compt. rend. 245, 1415-18(1957). (In French)

The gamma spectrum from the inelastic scattering of 2.5 Mev neutrons in iron was measured with a Tl activated NaI crystal. The energy values found are 0.845, 1.25, 1.61, 1.70, 1.83, and 2.15 Mev. (tr-auth)

3344

ON THE p-p SCATTERING AT HIGH ENERGIES. A. Das (Indian Association for the Cultivation of Science, Jadavpur, Calcutta). Indian J. Phys. 31, 511-15(1957) Oct.

The nature of p-p scattering is studied with a phenomenological potential of the form $(\tau^{(1)} \cdot \tau^{(2)})\,(\sigma^{(1)} \cdot \nabla)\,(\sigma^{(2)} \cdot \nabla)\,e^{-\chi r}/r^3$. (auth)

3345

RADIATION DIFFUSION IN SEMI-FINITE MEDIUM. V. V. Sobolev. Doklady Akad. Nauk S.S.S.R. 116, 45-8(1957) Sept. 1. (In Russian)

It is shown that the solution for problems of radiation diffusion in semi-finite media of different radiation source distributions can be developed by the same function which depends only on the optical depth. (R.V.J.)

3346

INELASTIC SCATTERING OF 185 Mev PROTONS ON OXYGEN, CALCIUM AND CARBON. H. Tyrén and Th. A. J. Maris (Univ. of Uppsala). Nuclear Phys. 4, 637-42(1957) Nov.

The energy spectra at various angles for the inelastic scattering of protons near 180 Mev on oxygen, calcium, and carbon have been measured with a magnetic analyzer. Maxima corresponding to excited states of the target nuclei have been resolved and some differential and total cross sections are reported. (auth)

3347

THE ASYMMETRY OF 155 Mev PROTONS ELASTICALLY SCATTERED FROM IRON, NICKEL AND COPPER. R. Alphonce, A. Johansson, and G. Tibell (Univ. of Uppsala). Nuclear Phys. 4, 643-7(1957) Nov.

The asymmetry of protons scattered elastically from iron, nickel, and copper has been measured in the angular region 5° to 26°. The conventional double scattering technique with range telescopes was used. The angular patterns are quite similar for the three elements and resemble the curves for carbon, oxygen, and calcium. (auth)

3348

POLARIZATION OF HIGH ENERGY PROTONS IN ELASTIC AND INELASTIC SCATTERING. Peter Hillman, A. Johansson, and H. Tyrén (Univ. of Uppsala). Nuclear Phys. 4, 648-61(1957) Nov.

The polarizations of 173 to 177 Mev protons inelastically and elastically scattered by carbon, oxygen, and calcium have been measured with an energy resolution of 2 to 2.5 Mev full-width at half-height equivalent. The polarizations of scattered protons corresponding to the low-lying levels of all three elements are large and show strikingly similar angular patterns. The higher levels are much less polarized. The elastic results differ from measurements of elastic asymmetries in having deeper minima, and have been extended to larger angles. (auth)

3349

SOME REMARKS CONCERNING MEASUREMENTS ON INELASTIC SCATTERING OF 155-185 Mev PROTONS ON CARBON, OXYGEN AND CALCIUM. Th. A. J. Maris and H. Tyrén (Univ. of Uppsala). Nuclear Phys. 4, 662-71 (1957) Nov.

Semi-quantitative theoretical expectations for the differential cross sections of high energy inelastic proton scattering are summarized and compared with the experi-

mental results for carbon, oxygen, and calcium. The general agreement is satisfactory. High energy proton scattering at small angles seems a promising tool for the study of the giant gamma resonances at least in light nuclei. Some remarks concerning the measured asymmetries and polarizations of the inelastically scattered protons are made. (auth)

3350

THE ASYMMETRY OF 155 Mev PROTONS ELASTICALLY AND INELASTICALLY SCATTERED FROM CARBON, OXYGEN, AND CALCIUM. R. Alphonce, A. Johansson, and G. Tibell (Univ. of Uppsala). Nuclear Phys. 4, 672-6 (1957) Nov.

The asymmetry of protons scattered elastically and inelastically from oxygen and calcium has been studied with the conventional double scattering technique using range telescopes. Results are given for the asymmetry in scattering from oxygen and calcium together with improved values of previously reported carbon data. The angular distributions of the elastic asymmetry are quite similar for the three elements. For the inelastic asymmetry of oxygen and calcium it has been possible to obtain only qualitative results. (auth)

3351

CALCULATION OF THERMAL GROUP CONSTANTS FOR MIXTURES CONTAINING HYDROGEN. C. D. Petrie, M. L. Storm, and P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, 728-44 (1957) Nov.

The calculation of averaged thermal diffusion coefficients and absorption cross sections for hydrogenous assemblies is discussed, and numerical results are presented. Comparison is made with available experimental information. The averages are taken over Wigner-Wilkins spectra, which assume moderation by a perfect gas of hydrogen atoms in the presence of a $1/v$ absorber. The Radkowsky prescription has been used to obtain transport cross sections for various compounds containing hydrogen. Power series expansions are presented which simplify the calculation of average diffusion coefficients for mixtures. (auth)

3352

NEUTRON AGE IN DIPHENYL. N. C. Francis, M. L. Storm, and P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, 745-7(1957) Nov.

3353

THE INTERACTION OF 0.15- TO 1.0-Mev NEUTRONS WITH U-238, U-235, AND Pu-239. Robert C. Allen (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 2, 787-93(1957) Nov.

The differential elastic scattering, total elastic scattering, and elastic transport cross sections for U^{238}, U^{235}, and Pu^{239} for 0.5- and 1.0-Mev neutrons are presented. The nonelastic reaction cross sections are given for these three materials for neutron energies of 0.25, 0.5, and 1.0 Mev and in addition for U^{238} for 0.15-Mev neutrons. The inelastic scattering cross sections for the excitation of the two lowest levels in U^{238} are also presented for neutron energies of 0.15, 0.25, and 0.5 Mev. (auth)

3354

THE LOW ENERGY ELASTIC SCATTERING OF NEUTRONS BY DEUTERONS. P. G. Burke (Univ. Coll., London) and H. H. Robertson (National Physical Lab., Teddington, Middx). Proc. Phys. Soc. (London) A70, 777-92(1957) Nov.

The elastic scattering of neutrons by deuterons at energies less than 16.6 Mev incident neutron energy has been calculated using a scattering equation similar to that of Buckingham and Massey and a central nuclear potential with Gaussian form. Five values of the effective range are considered, covering all values of physical significance. For analytical convenience, a deuteron wave function consisting of two Gaussians is used, the deuteron binding energy being minimized with respect to three parameters. S and P phases for several energies were evaluated with the aid of electronic computers (Pilot ACE and DEUCE) for Serber, ordinary and symmetrical exchange forces. From the total cross section below 2 Mev it appears that the potentials of larger effective range agree best with experiment, although the doublet scattering length considerably exceeds the experimentally estimated value for all these potentials, probably because of polarization effects at low energies. From the P phases, conclusions are drawn about the validity of the Born approximation used by Christian and Gammel. The problem is then resolved for the short range potential using an adaptation of the variational methods of Hulthén and Kohn. The results at low energies compare favorably with the exact solution obtained previously. It therefore seems that the variational method may be used successfully when polarization of the deuteron is explicitly allowed for, and further calculations including this effect and using the Kohn method are in progress. (auth)

3355

INELASTIC SCATTERING OF 2.6-Mev NEUTRONS FROM Fe^{54}, Fe^{56}, AND Fe^{57}. P. Shapiro and R. W. Higgs (U. S. Naval Research Lab., Washington). Phys. Rev. 108, 760-5 (1957) Nov. 1.

Gamma rays following inelastic scattering of 2.6-Mev d-d neutrons from isotopically enriched samples of Fe^{54}, Fe^{57}, and from normal iron have been observed in a NaI scintillation spectrometer using the He^3 coincidence technique. The observed gamma rays are listed and are assigned to particular isotopes of the elements studied. Decay schemes are proposed for Fe^{54}, Fe^{56}, and Fe^{57}. (auth)

3356

ANALYSIS OF ELASTIC SCATTERING AND POLARIZATION OF 300-Mev PROTONS. F. Bjorklund, I. Blandford, and S. Fernbach (Univ. of California, Livermore). Phys. Rev. 108, 795-9(1957) Nov. 1.

Optical-model calculations were carried out on an IBM-704 computer for 300-Mev protons incident on various nuclei. Both differential cross sections and polarization curves were obtained and compared with existing experimental data. (auth)

3357

SCATTERING OF PROTONS BY HELIUM BETWEEN 11.4 Mev AND 18 Mev. Karl W. Brockman (Princeton Univ., N. J.). Phys. Rev. 108, 1000-6(1957) Nov. 15.

Measurements of the elastic differential cross section for the scattering of protons by helium have been made at 12 energies between 11.4 and 18 Mev. Ten scattering angles were used spaced at 15° intervals from 30° to 165° in the laboratory system; however, not all the angles were used at each energy. Standard gas-scattering techniques were employed. Scattered particles were detected by a scintillation counter and recorded on a 20-channel pulse-height analyzer. At nine of the scattering angles (165° excluded), smoothed curves of the cross section versus energy were plotted and values taken from these curves were analyzed in terms of S- and P-wave phase shifts. Two separate sets of S and P phase shifts intersecting at about 13 Mev were found. Least-squares fits are given for the solutions which are a continuation of phase-shift analyses at lower energies. Attempts to include D waves in the fits failed. There is

evidence that D phase shifts remain less than about 8° up to 16 Mev; however, at 18 Mev it appears that some D wave may be required. Rough agreement with current polarization experiments is cited. (auth)

3358

DIFFERENTIAL CROSS SECTION FOR 3.7-Mev NEUTRONS SCATTERED FROM ZIRCONIUM AND MOLYBDENUM. H. S. Hans and S. C. Snowdon (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 108, 1028-31(1957) Nov. 15.

The differential cross sections for the scattering of 3.7-Mev neutrons from Zr and Mo have been measured in a ring geometry by using a Bonner-type scintillation detector. The measurements were taken over an angular range of 124 degrees between 18 and 142°. Angular resolution effects have been removed by iteration. Multiple scattering effects have been removed by a Monte Carlo type calculation. (auth)

3359

PHOTON SCATTERING FROM PROTONS AND DEUTERONS. R. H. Capps (Univ. of Washington, Seattle). Phys. Rev. 108, 1032-5(1957) Nov. 15.

The scattering of dipole photons of 100 to 200 Mev from protons and deuterons is calculated by means of dispersion relations, experimental data on photopion production from nucleons, and several reasonable approximations. A previous calculation by the author using this model is modified by the use of an additional dispersion relation derived by Mathews. The differential cross sections resulting from this modification are smaller than the previously calculated cross sections for scattering angles in the backward direction. Comparison of the photon-deuteron calculations with the results of future experiments will yield information concerning the photon-neutron scattering amplitude. (auth)

3360

NEW DISPERSION RELATIONS FOR PION-NUCLEON SCATTERING. Walter Gilbert (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 1078-83(1957) Nov. 15.

New relations expressing the imaginary part of the scattering amplitude as a coupling constant term and an integral over the physical spectrum of the real part of the amplitude are developed. These relations are applied to compute the meson-nucleon coupling constant from the experimental phase shifts, yielding the value $f^2 = 0.084$, and are used to compute the s-wave scattering lengths from the p-wave data. (auth)

3361

AN EXPERIMENTAL DETERMINATION OF ENERGY ABSORBED IN WATER FROM AN X-RAY BEAM. Gail D. Adams (Univ. of California School of Medicine, San Francisco). Radiology 69, 867-80(1957) Dec.

An experimental method is presented for determining absorbed dose in water. The method employs a calorimeter to measure the energy content of an x-ray beam and requires detailed knowledge of the absorption of most of this energy in a water bath, considered tissue-equivalent for these purposes. The method is applied to two narrow beams of x-rays from a 70-Mev synchroton. (auth)

3362

THREE BODY PROBLEM FOR SHORT RANGE FORCES. I. SCATTERING OF LOW ENERGY NEUTRONS BY DEUTERONS. G. V. Skorniakov and K. A. Ter-Martirosian. Soviet Phys. JETP 4, 648-61(1957) June.

An exact solution is obtained for the three body problem in the limiting case of a vanishingly small radius of action of the forces. In this case, the Schrödinger equation for the system of three particles reduces, for motion with a definite momentum, to an integral equation for a function of a single variable. The solution is used for the calculation of the neutron-deuteron scattering cross section. In the limiting case of zero energy of the neutrons, the theory gives the values $a_{3/2} = 0.51 \times 10^{-12}$ cm, $a_{1/2} = 0.30 \times 10^{-12}$ cm for the scattering amplitudes. (auth)

3363

POLARIZATION OF RELATIVISTIC PROTONS IN COULOMB SCATTERING. M. G. Urin and V. N. Mokhov (Moscow Inst. of Engineering Physics). Soviet Phys. JETP 4, 738-40(1957) June.

Perturbation theory was used to determine the polarization of relativistic protons which experience Coulomb scattering. (auth)

3364

INELASTIC SCATTERING CROSS SECTIONS OF NUCLEI FOR 2.5 Mev NEUTRONS. V. I. Strizhak (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 769-70 (1957) June.

The inelastic scattering cross sections for 2.5 Mev neutrons were measured for the following materials: Na, Mg, Al, P, S, Cl, Ca, Cr, Fe, Co, Ni, and Cu. The results make possible the following conclusions: (1) the inelastic cross sections for 2.5 Mev neutrons for most nuclei increase smoothly with mass number; and (2) nuclei having a magic number of nucleons have inelastic scattering cross sections that are significantly smaller than neighboring nuclei. (A.C.)

3365

ON THE IMPROVEMENT OF PERTURBATION THEORY FORMULAS. R. V. Tevikyan (Erevan State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 473-80(1957) Aug. (In Russian)

The n-fold Compton effect and scattering of electrons and positrons on electrons at high energies are studied by considering the vacuum polarization diagrams composed of simple closed loops. (tr-auth)

3366

ON THE CROSS SECTION OF ELECTRON CAPTURE. V. S. Nikolaev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 534-5(1957) Aug. (In Russian)

3367

REMARKS CONCERNING THE ELASTIC SCATTERING OF RELATIVISTIC PARTICLES IN STATIONARY FLUX. N. A. Chernikov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 541-2(1957) Aug. (In Russian)

3368

SCATTERING OF SLOW NEUTRONS BY DIATOMIC MOLECULES. A. A. Anselm (Leningrad Inst. of Physics in Tech., Academy Nauk, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 625-33(1957) Sept. (In Russian)

The cross sections for elastic and inelastic scattering of neutrons by molecules composed of two identical or different atoms are computed. The general formulae thus obtained are used to study scattering on T_2, HT, and DT molecules. Comparison of the scattering cross sections in these gases with the obtained theoretical formulae permits one to determine the scattering amplitude for neutrons on a tritium nucleus. (tr-auth)

3369

ON THE SCATTERING OF ELECTRONS BY PROTONS. A. I. Akhiezer, L. N. Rozentsveig, and I. M. Shmushkevich. Zhur. Eksptl'. i Teoret. Fiz. 33, 765-72(1957) Sept. (In Russian)

It is shown that under some very general assumptions, scattering of electrons by protons is determined by two real functions $a(q^2)$ and $b(q^2)$ of the invariant $q^2 = (p_1 - p_2)^2$ (p_1 and p_2 are four-dimensional electron momenta before and after the collision). Experiments with pola-

rized electrons and protons are considered which permit one in principle to determine the particular form of the functions $a(q^2)$ and $b(q^2)$. (tr-auth)

3370

ADAPTATION OF CHARGE INVARIANCE TO POLARIZATION PHENOMENA. S. M. Bilen'kiĭ (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 821-2 (1957) Sept. (In Russian)

3371

EFFECTS OF ATTENUATION ON POLARIZATION OF DIRAC PARTICLES IN SCATTERING. A. A. Sokolov and B. K. Kerimov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 827-9(1957) Sept. (In Russian)

Calculations were made of polarization occurring in elastic scattering of Dirac particles based on the attenuation theory. (R.V.J.)

Radiation Effects

3372 AD-125193

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
IRRADIATION OF P-N JUNCTION DIODES (thesis). William Matscher. Mar. 1957. 51p.

In an attempt to determine the effects of gamma radiation on germanium p-n junction diodes, the back characteristics of type 1784 diodes were measured while they were exposed to a gamma intensity of 3.5×10^5 r/hr from a Co^{60} source. The electrical properties of germanium diodes are known to be structure sensitive. The relative changes produced in the body and the surface as a result of gamma irradiation is a prime object of this report. Diodes with treated and untreated surfaces were used to gain information on the surface effects. (auth)

3373 AECU-3588

Illinois, Univ., Urbana.
EXPANSION OF COPPER UPON LOW TEMPERATURE DEUTERON IRRADIATION. Technical Report No. 12. Richard Werner Vook. Sept. 1957. 35p. Contract AT(11-1)-182. $6.30(ph OTS); $3.00(mf OTS).

Average value of the specific change in length per deuteron per cm^2 for 8.5-Mev deuterons is 3.8×10^{-21}. This expansion was observed to be a linear function of integrated flux. Using a value of 1.5 v_a, where v_a is the atomic volume, for the volume increase due to a Frenkel pair in copper, the calculated concentration of defects is $\frac{1}{6}$ that predicted by the simple theory of Seitz and Koehler, and $\Delta a/a$ equals $\Delta L/L$ to 11% during irradiation on the assumption that the energy dependence of deuteron damage in copper varies inversely with the deuteron energy. Where comparison is possible, recovery of $\Delta L/\Delta L_{max}$ follows that of $\Delta a/\Delta a_{max}$ to better than 10%. For $\Delta L/\Delta L_{max}$ 64% of the damage anneals in Stage I (< 70°K), 6% anneals in Stage II (70 to 180°K), 26% anneals in Stage III (180 to 300°K), and 4% remains at 300°K. (auth)

3374 CF-54-4-221(Del.)

Oak Ridge National Lab., Tenn.
RADIATION DAMAGE TO ELASTOMERS, LUBRICANTS, FABRICS AND PLASTICS. Apr. 15, 1954. Decl. with deletions Feb. 19, 1957. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Elastomers, plastics, fabrics, gaskets, insulators, organic materials, and lubricants were irradiated to evaluate the changes in physical properties for various total doses in rep and to determine the usefulness of the material in the irradiated condition. (L.T.W.)

3375 NARF-57-53-T

Convair, Fort Worth, Tex.
RADIATION DAMAGE TO METAL BONDED AND SANDWICH PANELS-I. R. E. Johnson and F. Sicilio. Nov. 26, 1957. 39p. Project 6(1-9964). Contract AF-33(600)-32054. (MR-N-163).

Samples of three types of panels were irradiated in air using the Ground Test Reactor. The three types were lap shear panels, aluminum- and fiberglass-core honeycomb panels, and corrosion-resistant steel honeycomb panels. In addition, two groups of clad aluminum lap shear panels were irradiated while immersed in various fluids. In the air-immersion irradiations, flux levels of 6×10^{14} $n_f$vt, 6×10^{13} $n_t$vt, and 5×10^{16} γ/cm^2 were attained. In the fluid-immersion irradiations, fluxes of 6×10^{14} $n_t$vt and 5×10^{16} γ/cm^2 were attained. After irradiation, engineering tests were made on both irradiated and control samples. Comparisons were made of the test results of the two groups to determine the effect of radiation on the materials. Most of the panels were found to be resistant to radiation at the levels experienced. Only the following changes were noted: Lap shear panels made with Plastilock 620-626 adhesive on magnesium to 2024-T3 clad aluminum showed a decrease in shear strength. Fiberglass-core aluminum-skin honeycomb panels made with Hexcel 422-J adhesive exhibited a decrease in column creep and shear strength. Corrosion-resistant steel sandwich panels decreased in face compression strength. (auth)

3376 NARF-57-54-T

Convair, Fort Worth, Tex.
RADIATION DAMAGE TO ELASTOMERS AND SEALANTS-I. R. E. Johnson and F. Sicilio. Nov. 26, 1957. 59p. Project 6(1-9964). Contract AF-33(600)-32054. (MR-N-174).

Elastomer and sealant samples were irradiated using the Ground Test Reactor at Convair-Fort Worth in October 1955. Both types of material were irradiated in air, and some sealant samples were irradiated while immersed in Type III hydrocarbon fuel. The samples irradiated in air received an average integrated fast neutron flux of 6×10^{14} nvt and an average integrated thermal neutron flux of 6×10^{13} nvt. The samples immersed in fuel were subjected to an average integrated thermal neutron flux of 6×10^{13} nvt. The gamma dose was approximately 5×10^6 γ/cm^2 for all samples. After irradiation and, in applicable cases, subsequent immersion in Type III fuel, testing was performed to yield physical and engineering parameters. Comparison was made with parameters determined from control samples not undergoing irradiation. A decrease was noted in the elongation of most of the elastomers as a result of irradiation. Very few changes were noted in those sealants immersed in air. Of the sealants irradiated while immersed in fuel, samples of PR 1201, and EC 1373 which had been topcoated with EC 776 showed decreases in tensile strength, while the uncoated EC 1373 samples exhibited an increase in tensile strength. Except for the case of uncoated PR 1201, all sealant samples in this last group increased in elongation. (auth)

3377 NP-6496

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON FLUORINATED POLYMERS IN DIFFERENT ENVIRONMENTS. R. I. Leininger. Oct. 31, 1957. 3p. Project 2133. Contract AF-33(616)-5171.

Data are presented on the irradiation of fluorinated polymers in air, argon, and jet turbine oil at 400°F by Co^{60} radiation. (W.L.H.)

3378

WIGNER GROWTH IN GRAPHITE. Nuclear Eng. 2, 527-8 (1957) Dec.

The Windscale accident has given prominence to the phenomenon termed Wigner growth whereby, under prolonged irradiation, graphite changes shape and stores energy. The mechanism can be simply described as the displacement of recoil atoms into the interplanar regions, resulting in a geometric distortion of the lattice and a consequent storage of energy Graphite manufactured from extruded material is anisotropic and, under irradiation, growth is predominant in the plane perpendicular to the direction of extrusion. In the direction of extrusion the growth is relatively small. The magnitude of the growth is a function of the amount and type of irradiation and of the ambient temperature; the higher the temperature, the less the growth, as some annealing takes place continuously. Irradiation also stimulates a certain amount of annealing. When the Windscale piles were built, the element of Wigner growth was recognized, but detailed information on the growth and on the energy build-up was sketchy. In September 1952, a spontaneous release of Wigner energy in No. 1 pile while it was shut down, leading to a rise in temperature of the graphite, sparked-off a study of the possibilities of a controlled energy release. Because of the Wigner growth in graphite, the structure in large masses in nuclear piles is considerably complicated and the measures that have been taken to accommodate the growth are discussed in three patents (Nos. 784291, 784292, and 785876), which have been recently released. (A.C.)

3379

STORED ENERGY IN NEUTRON-BOMBARDED GRAPHITE. T. J. Neubert and R. B. Lees (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 748-67(1957) Nov.

Fast neutron bombardment of graphite displaces carbon atoms to interstitial positions and produces lattice vacancies. Upon heating the interstitial disturbances become mobile, move to more stable positions and release stored energy. The thermal release of stored energy was investigated by relative specific heat measurements, which are described in detail. Data are presented which show the dependence of energy storage upon extent of neutron bombardment and upon temperature of bombardment. Activation energy spectra for the thermal release of stored energy are calculated. The general trends of the data are discussed. Estimates are made of the numbers of interstitial carbon atoms, interstitial carbon (C_2) molecules, and lattice vacancies in a sample of low bombardment. It is suggested that annealing of irradiated graphite causes much of the interstitial material to reintegrate with the graphite lattice by filling lattice vacancies. (auth)

3380

RADIATION MAKES BETTER, LONGER-LASTING TIRES. Charles H. Stockman, Dale J. Harmon, and Harry F. Neff (B. F. Goodrich Co., Brecksville, Ohio). Nucleonics 15, No. 11, 94-7(1957) Nov.

Preliminary tests indicate that radiation vulcanization produces better, longer-lasting tires than conventional curing. (L.T.W.)

3381

ELECTRON IRRADIATION OF COPPER NEAR 10°K. J. W. Corbett, J. M. Denney, M. D. Fiske, and R. M. Walker (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 108, 954-64(1957) Nov. 15.

The resistivity change induced by electron irradiation of zone-refined Cu maintained at ~ 10°K has been measured over the range of bombarding electron energies from 0.70 to 1.37 Mev. The cross section for damage production is shown to be insensitive to the choice of the shape of the displacement probability function for this energy range. An "average" threshold energy for displacement of 22 ± 3 ev is deduced, from which the resistivity of Frenkel pairs, $\rho_f = 1.45 \pm 0.5$ μohm cm/atomic % is obtained. Isochronal and isothermal annealing studies of irradiations performed at 1.37 Mev are described. The maximum annealing rate, as obtained from an isochronal anneal, occurs at ~ 40°K; ~90% of the irradiation-induced resistivity annealing out in the range 20 to 65°K. The isothermal annealing curves are not amenable to analysis in terms of a single simple rate process, but seem to require a multiplicity of processes. (auth)

3382

EFFICIENCIES AND PHOTOFRACTIONS FOR SODIUM-IODIDE CRYSTALS. W. F. Miller, John Reynolds, and William J. Snow (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 28, 717-19(1957) Sept.

Efficiencies and photofractions for monoenergetic gamma rays, from a broad parallel beam, incident on sodium-iodide crystals of various sizes have been calculated by the Monte Carlo method. The calculations were carried out for photon energies of 0.279, 0.661, 1.33, 2.62, and 4.45 Mev; the crystals considered were right circular cylinders with radii of 1.0, 2.0, 4.0, 8.0, 12.0, and 16.0 in. and, for each radius, crystals of heights 1.0, 2.0, 4.0, and 8.0 in. The effect of the escape of annihilation gammas from the crystal was taken into account in the Monte Carlo calculation; however no correction was made for escape of bremsstrahlung. This correction is important only at the largest energies and for the smallest crystals where it affects the photofraction by a few percent. (auth)

Radioactivity

3383

STUDY OF THE INFLUENCE OF THE TERM OF FIERZ ON THE FORM OF THE β^- SPECTRUM OF Y^{90}. T. Yuasa, J. Laberrigue-Frolow, and L. Feuvrais. J. phys. radium 18, 559-61(1957) Oct. (In French)

The precise study of the form of the β^- spectrum of Y^{90} permitted the evaluation of the eventual participation of the interaction A as less than 3% of that of T in this disintegration: $\varphi \leq 0.03$. (auth)

3384

GAMMA RAYS FROM THE EXCITED STATES OF ^{16}O. Tetsuo Wakatsuki, Yasuo Hirao, Eiji Okada, and Iwao Miura (Osaka Univ.). J. Phys. Soc. Japan 12, 1178-85 (1957) Nov.

By bombarding a fluorine target with 5.7-Mev protons, a new gamma radiation of energy 3.86 ± 0.02 Mev was observed with a three crystal pair spectrometer. This gamma radiation was proved to be emitted from a 10.98-Mev (or 10.77-Mev) state in O^{16} in the transition to 7.12-Mev (or 6.91-Mev) state by gamma-gamma coincidence experiments. No gamma radiation corresponding to the transitions from this state to other lower states in O^{16} was observed. 0^- (or 3^+) was assigned to this state. An 8.87-Mev gamma radiation corresponding to the direct transition to the ground state from the 2^- excited state in O^{16} was observed. A hard gamma radiation of about 11-Mev energy was found at proton energies between 4.8 and 5.7 Mev and was ascribed to the capture radiation in $F^{19}(p\gamma)Ne^{2}$ reaction. A weak gamma radiation of about 4.9-Mev energy was also observed. (auth)

3385

RADIOACTIVITY OF SEA-FLOOR SEDIMENTS OFF VISAKHAPATNAM. A. V. R. Sastry and C. Mahadevan (Andhra Univ., Waltair). J. Sci. Ind. Research (India) 16B, 429-31(1957) Oct.

From the radioactivity and carbonate content data of some representative sea-floor sediments off Visakhapat-

nam, it has been inferred that the high carbonate content corresponds to low radioactivity of the sediment. The data also support earlier work on zonal distribution of these sediments. (auth)

3386

PARITY VIOLATION IN β-DECAY: CORRELATION OF THE ELECTRON DIRECTION WITH THE POLARIZATION OF A SUBSEQUENTLY EMITTED NEUTRON. G. A. Jones and F. Mandl (Atomic Energy Research Establishment, Harwell, Berks). Nuclear Phys. 4, 690-2(1957) Nov.

Parity violation will produce observable effects in the case of delayed neutron emission; the delayed neutron will in general be polarized along the direction of the preceding electron, the degree of polarization being dependent on the direction of emission of the neutron relative to the electron. In the case considered the polarization is a maximum for neutrons emitted in a direction perpendicular to that of the electrons and is perpendicular to the direction of motion of the neutron, this being the most convenient for detection. In contrast, emission of γ radiation following β decay results only in circular polarization. Some details are given concerning a projected experiment to measure the polarization correlation in the decay of N^{17}. (auth)

3387

P^{32} HALF-LIFE DETERMINATION. Oswald U. Anders and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Nucleonics 15, No. 12, 68, 70(1957) Dec.

A sample of high-purity P^{32} yielded a half-life value of 14.233 ± 0.015 days (standard deviation), which is slightly smaller than most reported values. It appears, therefore, that systematic errors involving impurities and data scatter have been minimized in this experiment. (L.T.W.)

3388

RADIOACTIVE DECAYS OF Au^{194}, Au^{196}, AND Au^{198}. David E. Alburger (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 812-16(1957) Nov. 1.

The de-excitations of the 2+ second excited states of Pt^{194} and Pt^{196} have been studied to compare crossover transition intensities to the 0+ ground states relative to the known cascade transitions to the 2+ first excited states. An intermediate-image beta-ray spectrometer was used to measure the internal-conversion electron spectra occurring in the decays of Au^{194} and Au^{196}. A conversion line is found in the decay of Au^{194} corresponding to a 0.618-Mev crossover having a transition intensity of 25% relative to the 0.290-Mev cascade, provided the latter is assumed to be E2. In Pt^{196} an upper limit of 0.04% is placed on the intensity of a possible crossover transition compared with the 0.331-Mev cascade. Au^{194} exhibits the internal-conversion lines of 36 gamma-ray transitions which fit energetically into a proposed energy level scheme for Pt^{194}. A search in the electron spectrum of Au^{198} showed no gamma-ray transitions other than the three already known. (auth)

3389

TIME REVERSAL INVARIANCE IN BETA DECAY. R. R. Lewis (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 904-5(1957) Nov. 1.

3390

PARITY NONCONSERVATION AND THE β SPECTRUM OF RaE. Jun-Ichi Fujita (Nihon Univ., Tokyo, Japan); Masami Yamada (National Research Council, Washington); and Zyun-Itiro Matumoto and Seitaro Nakamura (Univ. of Tokyo, Japan). Phys. Rev. 108, 1104-6(1957) Nov. 15.

It is pointed out that, if the Gamow-Teller component of the β-decay interaction is of the tensor type and if $C_T = -C_T'$ (C and C' are the parity conserving and nonconserving coupling constants, respectively), it is very difficult to explain the shape of the β spectrum of RaE (Bi^{210}) by the Fermi theory unless the following conditions are met approximately: (a) the Fermi component is of the scalar type; (b) $C_S = -C_S'$; and (c) C_S/C_T = real. (L.T.W.)

3391

THE DECAY OF ^{90}Nb. Raymond K. Sheline. Physica 23, 923-42(1957) Oct.

Nb^{90} produced by the (p,n) reaction on separated Zr^{90} was studied by scintillation beta and gamma spectroscopic methods. The 14.56 ± 0.05 hr activity emitted positions with an end point of 1.48 ± 0.03 Mev and photons of 0.0176 ± 0.001, 0.133 ± 0.003, 0.142 ± 0.002, 0.370 ± 0.005, 0.511 ± 0.003, 0.900 ± 0.010, 1.137 ± 0.006, 2.200 ± 0.020, and 2.330 ± 0.010 Mev. Relative intensities of most of the transitions have been determined. The anisotropy of the 0.142 to 1.137 Mev cascade is −0.112 ± 0.046. These measurements together with coincidence measurements have been used to assign the following levels (in Mev) and spins in the daughter nucleus Zr^{90}: 1.77 (0+), 2.20 (2+), 2.33(5−), 3.10, 3.47 (6+), and 3.61 (8+). Following the suggestion of Ford, these levels are interpreted as proton levels arising from the ground state configuration $(p_{1/2})^2$ and the two excited state configurations $(g_{9/2})^2$ and $(g_{9/2}\ p_{1/2})$. All states expected from these configurations are observed, with the exception of the $(g_{9/2}\ p_{1/2})_{4-}$ and the $(g_{9/2})^2_{4+}$ states. The relative population of the ground and first excited 0+ states in the beta decay of Y^{90}, and in the deexcitation of the 2.20 (2+) state in Nb^{90}, indicate that these states are highly mixed $(p_{1/2})^2$ and $(g_{9/2})^2$ states. Other states are shown by a variety of criteria to be relatively pure. A simple method to calculate the half life of the 1.77 Mev 0 + → 0 + transition in Zr^{90} yields the value 2.0×10^{-9} sec. (auth)

3392

THE DECAY SCHEMES OF THE FISSION-PRODUCT NUCLIDES: Mo^{102}, Mo^{105}, Tc^{102}, AND Tc^{105}. J. Flegenheimer and W. Seelmann-Eggebert. Publs. com. nacl. energia atomica (Buenos Aires) Ser. quim. 1, No. 7, 63-79(1956). (In Spanish)

A half life of 5 sec ± 1 sec was found for the technetium daughter of the 11 minute molybdenum present in the fission products, whose probable mass number is 102. Absorption measurements show a maximum beta energy of 4.4 Mev ± 0.3 Mev. From the absorption curves a half life of 11.5 min ± 0.5 min is found for Mo^{102}. The Tc^{105} half life was found to be 10 min ± 1 min through timed precipitations from a stock solution of fission technetium and measurements of the Ru^{105} formed. Ru^{106} as radioactive indicator was used to show the purity of technetium isolations or to avoid weighing when distilling ruthenium. Through technetium isolations from quickly purified fission-molybdenum, an upper limit of 2 minutes could be established for the half life of Mo^{105}. No other technetium half lifes were found when milking from fission molybdenum. (auth)

3393

ALPHA DECAY OF Pu^{240}. L. N. Kondrat'ev, G. I. Novikov, Iu. P. Sobolev, and L. L. Gol'din. Soviet Phys. JETP 4, 645-7(1957) June.

In this work results are given of investigations on the α spectrum of Pu^{240} carried out with the help of an α spectrometer. The α spectra obtained are presented along with a level scheme for the U^{236} nucleus. The parameters of the 4^+ level are given with precision; the first α line corresponding to the transition to a 6^+ level is observed, and the parameters of this level measured; two weak lines are found which can be assigned to the α decay of Pu^{240}. A comparison of the experimental data with the theoretical formula of Landau is made for the intensities of the 0^+, 2^+, 4^+, and 6^+ levels. (auth)

3394
ON THE TOTAL ENERGY OF THE β-TRANSITION RaC-RaC'. A. V. Kogan and I. A. Sokolov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 767-8(1957) June.

3395
FLUCTUATIONS OF THE CONCENTRATION AND THE RATIO OF RADON AND THORON DECAY PRODUCTS IN THE AIR FROM MEASUREMENTS IN THE NORTHERN ALPS. Reinhold Reiter. Z. Naturforsch. 12a, 720-31(1957) Sept. (In German)

3396
EFFECTS OF ATOMIC ELECTRIC FIELD ON β DECAY. B. S. Dzhelepov and L. N. Zyryanova. Academy of Sciences U.S.S.R., Khlopin Radium Inst., Leningrad, 1956. 312p. (In Russian)

Effects of the atomic electric field on the energy distribution of β particles and on the lifetime of β-radioactive nuclei are investigated. The tables of functions connected with β decay are included. (R.V.J.)

3397
GAMMA RADIATION FROM RADIOACTIVE BODIES. G. V. Gorshkov. Leningrad University Publishing House, 1956. 136p. (In Russian)

Evaluations are made of gamma radiation intensities from radioactive bodies of various geometric shapes and volumes. The secondary effects connected with the gamma ray traverse of materials and evaluations of the secondary ray influence on the general attenuation of gamma radiation traversing a material are reported in a reference book designed for the seniors of technical universities and for the scientists and engineers working with radioactive materials. (R.V.J.)

Rare Earths and Rare-earth Compounds

3398
^6P STATE OF THE Gd^{+++} ION. S. P. Cook and G. H. Dieke (Johns Hopkins Univ., Baltimore, Md.). J. Chem. Phys. 27, 1213(1957) Nov.

3399
PREPARATION AND MAGNETIC PROPERTIES OF PYROCHLORE-TYPE TITANATES OF NEODYMIUM AND PRASEODYMIUM. R. C. Vickery and Ardys Klann (Horizons, Inc., Cleveland, Ohio). J. Chem. Phys. 27, 1220-1 (1957) Nov.

3400
MAGNETIC SUSCEPTIBILITIES OF VANADATES OF NEODYMIUM AND PRASEODYMIUM. R. C. Vickery and Ardys Klann (Horizons, Inc., Cleveland, Ohio). J. Chem. Phys. 27, 1219-20(1957) Nov.

3401
NUCLEAR SPECTROSCOPY OF NEUTRON-DEFICIENT RARE EARTHS (Tb THROUGH Hf). J. W. Mihelich, B. Harmatz, and T. H. Handley (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 989-99(1957) Nov. 15.

A survey has been made of electron-capturing nuclides produced by irradiating rare earths (Gd through Hf) of various isotopic enrichments with 22-Mev protons. Ion-exchange chemistry was performed, conversion-electron spectra were analyzed, and the various activities were cataloged. At least ten new activities, Tb^{153}, Tb^{155}, Tb^{156m}, Dy^{155}, Ho^{154}, Ho^{160m}, Ho^{162}, Er^{161m}, Yb^{171m}, and Lu^{169}, were found and studied. Eighteen previously known activities also were examined. Multipolarities consistent with the observed conversion electron intensity ratios are proposed. The positions of levels of even-even nuclei as a function of both proton and neutron number are discussed. (auth)

3402
FISSION OF URANIUM AND PROTACTINIUM AT HIGH EXCITATION ENERGIES V. P. Shamov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 346-53(1957) Aug. (In Russian)

Fission of U and Pa for initial excitation energies of 100 Mev is considered. The analysis is based on comparison of the yields of the uranium isotopes U^{236}—U^{232} and protactinium isotopes Pa^{231}—Pa^{227} (equal values of the parameter Z^2/A) produced in the disintegration of uranium U^{238} by 340 Mev protons. The results of the analysis point to emission nature of U and Pa fission in the indicated range of initial excitation energy. (tr-auth)

3403
PHASE DIAGRAM FOR CERIUM. A. I. Likhter, Yu. N. Ryabinin, and L. F. Vereshchagin (Lab. of Physics of Supersonic Pressures, Academy of Sciences. USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 610-13(1957) Sept. (In Russian)

The p—T-diagram for cerium of 99.8% purity has been measured from −150° to + 100°C in a pressure range up to 12000 kg/cm^2. In p—T coordinates the line of phase equilibrium is a straight line with a slope of 43 kg/cm^2 grad. It is shown that the transition occurring at atmospheric pressure and low temperature and the transition at room temperature and high pressures are identical phase transitions. (tr-auth)

Shielding

3404 CF-52-11-136(Del.)
Oak Ridge National Lab., Tenn.
THERMAL NEUTRON FLUX BEYOND THE BOTTOM SHIELD MOCKUP. G. T. Chapman and J. D. Flynn. Nov. 5, 1952. Decl. with deletions Apr. 19, 1957. 8p. $1.80 (ph OTS); $1.80(mf OTS).

The tested mockup was composed of Be, Fe, Pb, and H_2O. Neutron doses at various positions beyond the shield are plotted. (D.E.B.)

3405 CF-53-6-187
Oak Ridge National Lab., Tenn.
A COMPARISON OF THE SHIELDING PROPERTIES OF IRON AND STAINLESS STEEL IN THE ORNL LID TANK (EXPT. 38). G. T. Chapman and J. D. Flynn. June 30, 1953. Decl. Apr. 22, 1957. 29p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Thermal neutron flux, fast neutron dose, and γ dose measurements were made behind several Be—stainless steel and Be—Fe configurations. Also measurements were taken behind various thicknesses of stainless steel alone. (L.T.W.)

3406 NARF-57-49-T
Convair, Fort Worth, Tex.
STUDIES IN SHIELDING-III. Monte Carlo Calculations of Neutron Scattering in Air. M. B. Wells. Nov. 4, 1957. 47p. Project 6(1-9964). Contract AF-33(600)-32054. (FZK-9-120).

A Monte Carlo method is described for calculating the angular distribution and energy spectrum of air-scattered neutrons. The method was used to solve the integrals that represent the contribution to the total-scattered flux from each order of scattering. Results of the calculations giving the scattered flux from a 3.25-Mev point monodirectional source are presented in both graphical and tabular form for various source angles and separation distances at 10,000-ft density altitude. (auth)

3407 TRDC/P-3
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PIPPA SHIELD DESIGN. C. C. Horton. July 9, 1953. 13p.

Previous calculations on the Pippa shield are revised in the light of fresh design data for Pippa and recent experimental data. The shield thickness of concrete, heat production in the shield, the activity of the pressure vessel, the activity of coolant and void air, and the activity of the asbestos linings are considered. Thermal neutron currents are calculated for the radial case, and for the axial case the observed datum from Windscale is used: that the emergent axial current is 0.01 of the maximum thermal neutron flux at the center. Flux calculated by alternative methods are shown for comparison. (M.H.R.)

3408 WAPD-P-192
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE GAMMA RAY SHIELDING OF IN-PILE EXPERIMENTS. Sumner Mayburg and Warren F. Witzig. May 12, 1952. Decl. May 2, 1957. 15p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The possibilities of using a gamma ray shield to reduce gamma heating in an in-pile experiment has been examined for the Materials Testing Reactor. It is found that an optimum shielding material has a high density, high melting point, good thermal conductivity, and a small ratio of the thermal neutron cross section to atomic weight. Lead, while not ideal, fits these experiments better than most materials. Because an effective shield must be at least a centimeter thick and well cooled, the shield requires more space than is available within the active lattice of the MTR. However, sufficient space may be available in other experimental holes. (auth)

3409 ZJ-015
Convair, San Diego, Calif.
NEUTRON PENETRATION BY THE MONTE CARLO METHOD. James E. Braley and R. E. Donaldson. May 29, 1957. 146p.

A calculation was made of the penetration of plane slabs of Pb and B loaded polyethylene by a plane parallel source of fast neutrons. The neutron energies used were 14, 10, 6.5, and 3 Mev. The slab thickness ranged up to 6 mean free paths and in one instance to 9 mean free paths. The spectral distributions of the transmitted and reflected neutrons were recorded as well as the volume distributed source of γ rays resulting from captures and inelastic scatterings. (auth)

Spectroscopy

3410 WADC-TR-57-359
Wright Air Development Center, Materials Lab., Wright-Patterson AFB, Ohio.
ANALYTICAL APPLICATIONS OF FAR INFRARED SPECTRA I HISTORICAL REVIEW, APPARATUS AND TECHNIQUES. Period Covered: September 1954 to December 1956. Freeman F. Bentley, Eugene F. Wolfarth, Nora E. Srp and Wilbert R. Powell. July 11, 1957. 62p. Project title: "MATERIALS ANALYSIS AND EVALUATION TECHNIQUES;" Task title: "IDENTIFICATION OF MOLECULAR AND MICROSTRUCTURE OF AIRCRAFT MATERIALS." (AD-142010).

A review of the work accomplished to date in the far infrared region is presented, and most of the available literature is cited. A double beam double pass spectrophotometer equipped with cesium bromide optics is described. This instrument extends the useful spectral range to 35 microns. The general features of the instrument's construction and its performance capabilities are discussed. Conventional infrared techniques were used, and in some instances simplified in obtaining infrared spectra in the cesium bromide region. Many common solvents such as carbon disulfide, furan, benzene, and dioxane, have large "open windows" in the long wavelength region and the infrared spectra of these and other solvents are given. The advantages of far infrared spectra, and some of the special techniques of obtaining infrared spectra in the cesium bromide region, are also discussed. (auth)

3411
CALIBRATION OF PRISM SPECTROMETERS FROM 1300-2100 cm^{-1}. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 27, 1229-30(1957) Nov.

3412
ELECTRODELESS DISCHARGE TUBES CONTAINING RARE EARTH AND HEAVY ELEMENT HALIDES. Frank S. Tomkins and Mark Fred (Argonne National Lab., Lemont, Ill.). J. Opt. Soc. Amer. 47, 1087-91(1957) Dec.

A method is described for the preparation of electrodeless discharge tubes containing very pure rare earth and heavy element halides. Successful tubes have been prepared using Nd, Pm, Tb, U, Pu, Np, and Am. The effect of changing vapor pressure of the metal in the discharge is discussed and representative spectra shown. (auth)

3413
CONVERSION PROCESSES USED IN HIGH-PRECISION GAMMA-RAY SPECTROSCOPY. D. B. Beard (Lockheed Aircraft Corp., Palo Alto, Calif.). Rev. Sci. Instr. 28, 724-5(1957) Sept.

Theoretical Physics

3414 AEC-tr-3023
NON-LOCAL AND NON-LINEAR FIELD THEORIES. D. I. Blokhintsev. Translated from Uspekhi Fiz. Nauk 61, 137-59(1957). 39p.

This paper was previously abstracted from the original language and appears in NSA, Vol. II, as abstract No. 7381.

3415
THE GRAVITON AND GRAVITATION IN FUNCTIONAL THEORY OF PARTICLES. Jean-Louis Destouches. Compt. rend. 245, 1518-20(1957) Oct. 28. (In French)

The following topics are discussed: the principles of the non-linear functional theory of particles with maximum spin of 2; the associated fields; gravitation potentials of those particles; and the connection of general relativity and unitary theories. (T.R.H.)

3416
RESOLUTION OF THE SCHRÖDINGER EQUATION OF TWO-ELECTRON ATOMS. III. CONTINUATION OF THE METHOD. SYMMETRICAL S-STATES. G. Munschy. J. phys. radium 18, 552-6(1957) Oct. (In French)

In the Schrödinger equation of two-electron atoms, the problem of the eigenvalues has been reduced to the resolution of a linear and homogeneous system of an infinity of unknown quantities, which are used to expand the solution in terms of a complete set of orthogonal functions. The elements of the symmetrical matrix of the linear system have been calculated next. The eigenvalues of the energy are the squares, with negative sign, of the roots of the determinant. The convergence of this procedure has been checked numerically. (auth)

3417

EXTENSION OF THE FUNCTIONAL THEORY OF PARTICLES TO THE NUCLEON AND PHOTON. Florence Aeschlimann. J. phys. radium, 18, 562-6(1957) Oct. (In French)

Generalization of the functional theory of particles is made: (1) to the case of a particle having an isotopic spin (in particular the nucleon); (2) to the case of a particle with "chirality"; 3° to the case of a particle obtained by the method of fusion (in particular the photon). Various forms of Louis de Broglie photon equations are given. Study is made of the relations assigned to the nonlinear terms. (auth)

3418

CORRELATION ENERGY OF AN ELECTRON GAS AT HIGH DENSITY: PLASMA OSCILLATIONS. K. Sawada, K. A. Brueckner, and N. Fukuda (Univ. of Pennsylvania, Philadelphia) and R. Brout (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 507-14(1957) Nov. 1.

The contribution from zero-point plasma oscillations to the correlation energy of an electron gas at high density is considered, using the exact high-density theory of Gell-Mann and Brueckner and of Sawada. The plasmon energy is determined as a function of q by an eigenvalue equation identical with the dispersion relation of Bohm and Pines. The plasma solutions are stable only below the energy-momentum values at which they merge with the continuum spectrum arising from particle excitation, thus introducing a natural cutoff into the theory. At high density, however, it is shown that this cutoff can be allowed to become infinite without affecting the correlation energy. The contribution from the plasma energy is exactly re-expressed in terms of the contribution from the scattering states by making use of the analytic properties of the scattering amplitudes. This transformation also establishes the connection between the Gell-Mann-Brueckner and Sawada results. Some remarks are finally made on the relation between these results and those of Bohm and Pines. (auth)

3419

CORRELATION ENERGY OF A HIGH-DENSITY GAS: PLASMA COORDINATES. R. Brout (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 515-17(1957) Nov. 1.

The model Hamiltonian of Sawada which describes electron correlation at high density is examined. It is shown that the set of scattering modes for momentum transfers below a certain q_{max} is not complete. It is completed by the plasma mode. $(q_{max})^{-1}$ is the natural Debye length of the theory. (auth)

3420

SELECTION RULES IMPLIED BY CP INVARIANCE. G. Feinberg (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 108, 878-81(1957) Nov. 1.

Some consequences of the rigorous invariance under the product of charge conjugation and reflection are discussed. The restrictions on the interactions of real boson fields with one spinor field, and of complex boson fields with charge symmetric spinor fields are derived and compared with the restrictions implied by invariance under the separate operations. Two selection rules for transitions among such boson fields are given. Some possible applications to known particles are mentioned. (auth)

3421

WAVE EQUATION FOR A MASSLESS PARTICLE WITH ARBITRARY SPIN. C. L. Hammer and R. H. Good, Jr. (Iowa State Coll., Ames). Phys. Rev. 108, 882-6(1957) Nov. 1.

A wave equation for a noninteracting particle with zero mass and arbitrary spin s is given in this paper. The Hamiltonian is proportional to the inner product of the momentum and spin operators so that the wave function has 2s + 1 components. As an auxiliary condition, solutions with spins not parallel or antiparallel to the momentum are discarded. With this condition the theory is Lorentz-covariant. The energy, momentum, and angular momentum are defined in terms of expected values of the usual type of displacement operator. The specialization $s = \frac{1}{2}$ is the two-component neutrino theory and $s = 1$ gives Maxwell's equations for the photon. (auth)

3422

NONLINEAR COUPLING IN LOW-ENERGY MESON THEORY. L. P. Horwitz (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 886-90(1957) Nov. 1.

It is shown that a very large class of meson-nucleon interactions leads to the same first-order scattering equations as would be obtained by adding simple nonlinear terms to the familiar linear pseudovector coupling in the Chew-Low-Wick formalism. The class of interactions under consideration is large enough to include what one would expect to be a reasonable form for the nonrelativistic limit of the charge-symmetric pseudoscalar interaction. In the gauge-invariant extension of the theory to photoproduction, the P-wave coupling constant is not exhibited explicitly in the energy-independent S-wave part of the inhomogeneous terms of the integral equation for the transition amplitude. It is shown directly, however, that the contribution of the higher order terms in the limit of zero total energy is exactly as required for the satisfaction of the Kroll-Ruderman theorem. (auth)

3423

PARITY NONCONSERVATION AND THE GROUP-SPACE OF THE PROPER LORENTZ GROUP. E. J. Schremp (U. S. Naval Research Lab., Washington). Phys. Rev. 108, 1076-7(1957) Nov. 15.

As a means of incorporating isotopic spin into the foundations of the theory of spin $\frac{1}{2}$ particles, a slight modification of the free-particle Dirac equations has previously been proposed which follows from a consideration of the group-space of the proper Lorentz group. Further considerations of the group-space suggest two additional modifications which may contribute, in a mutually complementary way, toward establishing a new symmetry principle applicable to parity-nonconserving interactions. (auth)

3424

ON THE CONSTRUCTION OF THE SCATTERING MATRIX. I. INTEGRAL CAUSALITY CONDITION IN BOGOLIUBOV'S METHOD. B. V. Medvedev (Academy of Sciences, USSR). Soviet Phys. JETP 4, 671-80(1957) June.

An integral causality condition is formulated in Bogoliubov's method for the construction of the scattering matrix. Starting from this method, the compatibility of the conditions imposed on the scattering matrix and the existence theorem for the matrix are demonstrated; the scattering matrix is obtained in explicit form for the local theory. (auth)

3425

THEORY OF NONLOCAL INTERACTION. V. S. Barashenkov. Soviet Phys. JETP 4, 709-12(1957) June.

The possibility of a Hamiltonian structure in the theory of nonlocal interaction is considered. By way of example, the one-dimensional oscillator is considered by Pauli's method. The initial integro-differential equations of motion and the canonical system of equations of motion obtained by Pauli's method are not equivalent. The procedure of Hayashi is shown to be internally inconsistent in any given order. Thus, conclusions about the essentially non-Hamiltonian character of nonlocal interactions are confirmed. (auth)

3426
ISOTOPIC INVARIANCE AND THE CREATION OF PARTICLES. L. I. Lapidus (Academy of Sciences, USSR). Soviet Phys. JETP 4, 740-8(1957) June.

The consequences of conservation of isotopic spin are investigated. Relations between different cross sections are found which are valid if in the meson-nucleon interaction a state with a particular value of isotopic spin predominates. The relations of Smorodinskii and Jacobson for elastic nucleon-nucleon cross sections are generalized for the case of meson and nucleon–antinucleon pair production. Furthermore, the consequences of isotopic spin conservation are given for the following cases: meson production on nuclei, creation of heavy meson pairs and nucleon antinucleon pairs in π-nucleon collisions, and for some processes of nucleon annihilation in collisions with deuterons. (auth)

3427
"SENIORITY" QUANTUM NUMBER SELECTION RULES IN NUCLEAR REACTIONS. V. G. Neudachin. Soviet Phys. JETP 4, 751-2(1957) June.

3428
CONCERNING A CERTAIN POSSIBILITY IN QUANTUM FIELD THEORY. Iu. M. Lomsadze (Moscow State Univ.). Soviet Phys. JETP 4, 754-5(1957) June.

The author has attempted to overcome the well known difficulties of contemporary relativistic quantum field theory which result, first, from the appearance of irremovable infinities in many unrenormalizable variants of the theory (among which are evidently all variants with an interaction Hamiltonian which either consists of the product of more than three field operators or contains the derivatives of these operators) and, secondly, from the divergence of series that are obtained after the elimination of all infinities in the renormalizable variants (particularly in electrodynamics). (A.C.)

3429
ACCURACY OF ISOBARIC SPIN FOR THE $1f_{\frac{7}{2}}$ SHELL. V. G. Neudachin. Soviet Phys. JETP 4, 756-7(1957) June.

3430
THE THEORY OF SLOWING DOWN OF NEUTRONS. A. Ia. Temkin (Petroleum Ministry of the USSR). Soviet Phys. JETP 4, 757-9(1957) June.

3431
CONSEQUENCES OF RENORMALIZABILITY OF PSEUDOSCALAR MESON THEORY WITH TWO INTERACTION CONSTANTS. V. V. Sudakov and K. A. Ter-Martirosian. Soviet Phys. JETP 4, 763-4(1957) June.

3432
DENSITY OF THE NORMAL COMPONENT FOR SOLUTIONS OF THE ISOTOPES OF HELIUM. N. G. Berezniak and B. N. Esel'son (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 766-7(1957) June.

3433
ON SOME ELECTROMAGNETIC EFFECTS INVOLVING STRONGLY INTERACTING PARTICLES. L. M. Afrikian and G. M. Garibyan (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 425-9 (1957) Aug. (In Russian)

Some electromagnetic effects involving strongly interacting particles are considered. The calculations are carried out within the framework of quantum electrodynamics by introducing form factors. It is shown that a study of the considered effects can be used to obtain information on the structure and properties of strongly interacting particles. (tr-auth)

3434
ON THE ENERGY DISTRIBUTIONS IN TWO PARTICLE DECAY REACTIONS. G. I. Kopylov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 430-41(1957) Aug. (In Russian)

A simplified method of calculation is offered for determining the intrinsic properties of the secondary particle and the primary particle spectra which was developed on the basis of the information obtained for the secondary particles. Symmetric properties of the spectrum of cascade decay products are demonstrated. By simple recalculation, analogous formulas were developed for the energy spectra, which can be also valid for the high energy part of the spectrum. The derived equations were used for the identification of the primary particles by their mass and for establishing the isotropy or cascade nature of the decay. (R.V.J.)

3435
ANOMALOUS EQUATIONS FOR SPIN ½ PARTICLES. I. Ulegla (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 473-7(1957) Aug. (In Russian)

New irreducible relativistic wave equations for spin ½ particles are deduced. They differ from the Dirac equations. The particles described by these equations may have one or more proper masses, and the corresponding fields have a positive definite charge density. The existence of such equations is not incompatible with the well known proof of uniqueness of the Dirac equations. (tr-auth)

3436
ON BOUND STATES IN POSITRONIUM. Yu. A. Tarasov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 706-9(1957) Sept. (In Russian)

The bound states of electrons and positrons were studied by investigating the poles of photon propagation functions. (tr-auth)

3437
ON SUPERPOSITIONS ACCORDING TO THE INTERNAL STRUCTURE OF ELEMENTARY PARTICLES. M. I. Podgoretskiĭ (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 790-1(1957) Sept. (In Russian)

It is pointed out that internal structure and internal motions determine the properties of elementary particles. Moreover, it is assumed that the general features of quantum mechanics are conserved; hence it is possible to expect the superpositions according to the various internal properties of the particles or the realization of states in which the elementary particle is not characterized by a definite value of a given internal parameter. (R.V.J.)

3438
ON GREEN'S FUNCTION IN RADIATION DIFFUSION RELATION. N. N. Kolesnikov (Moscow Inst. of Energy). Zhur. Eksptl'. i Teoret. Fiz. 33, 817-19(1957) Sept. (In Russian)

Uranium and Uranium Compounds

3439 AERE-C/M-324
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
U^{235} THERMAL FISSION PRODUCT ACTIVITIES AND EMISSION POWERS PLOTTED AGAINST IRRADIATION AND DECAY TIMES. E. A. C. Crouch. July 1957. 10p.

The β and γ activities and emission powers of the total fission products of U^{235} have been plotted against times of irradiation and decay in the range 1 to 1000 days. (auth)

3440 HW-39050
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DISCUSSION WITH WAPD PERSONNEL REGARDING

OXIDE FUEL MATERIALS. M. J. Sanderson. Sept. 16, 1955. Decl. Apr. 12, 1957. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Progress made in the evaluation of UO_2 fuel elements is summarized. UO_2 fuel elements are prepared by cold pressing and sintering UO_2 and cladding with Zircaloy. With controlled C content little corrosion or dimensional change was found. It is believed that fission gas production will be lower in irradiation with denser compacts of UO_2. (F.S.)

3441 NAA-AL-93(Rev.)
North American Aviation, Inc., Los Angeles, Calif.
IMPREGNATION OF POROUS GRAPHITE WITH URANIUM. Manuel C. Sanz. Jan. 6, 1947. Decl. Mar. 15, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

A method for impregnating porous graphite with UO_2 using uranyl nitrate hexahydrate is described. The theoretical amount of possible impregnation based on graphite of 25% porosity and apparent density 1.67 using uranyl nitrate hexahydrate, uranium carbide, and uranium metal is tabulated. The analytical method employed for the determination of uranium in graphite is outlined. (L.T.W.)

3442 USNRDL-TR-187
Naval Radiological Defense Lab., San Francisco.
GAMMA DECAY OF FISSION PRODUCTS FROM THE SLOW-NEUTRON FISSION OF U^{235}. C. F. Miller. July 11, 1957. 131p. Project NS-081-001.

Photon energy radiation rates and photon emission rates from the fission products produced by slow-neutron bombardment of U^{235} are computed, using nuclear decay scheme data and the results of new computations for the gross activity in terms of disintegration rate. The computed rates were used to determine, as a function of time after fission, the mean photon energy per disintegration, and the number of beta rays per photon. Curves showing photon energy radiation rates, photon emission rates, and beta rates for a time range of about 46 min to about 300 years after fission are presented. The relative percent contributions of the fission product elements to the photon energy radiation rate for the same time range are listed and plotted. A comparison is made of activity and the computed photon energy radiation rates for 1 hr to 3 years after fission. A comparison is also made of the number of fissions and neutron capture/fission ratio for neutron bombarded samples of U^{235} and of $U^{235} + U^{236}$ as determined by the decay curve analyses and by radiochemical analyses. The computed decay curves for 10^4 fissions from slow-neutron fission of U^{235} using the USNRDL 4-pi Ionization Chamber is presented. (auth)

3443 WAPD-RM-145
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
URANIUM HANDLING FOR CVR EXPERIMENTS. R. J. Creagan and A. F. Henry. Oct. 21, 1952. Decl. Mar. 12, 1957. 18p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Criticality and radioactivity considerations for processing and shipping Al-clad natural-U rods about 5 ft long are given. The material is for Carrier Vessel Reactor criticality experiments at BNL and WAPD. (T.R.H.)

3444
FLUORESCENT LIFETIMES OF URANYL SALTS AT DIFFERENT TEMPERATURES. L. A. Hall and G. H. Dieke (Johns Hopkins Univ., Baltimore, Md.). J. Opt. Soc. Amer. 47, 1092-6(1957) Dec.

The decay of the fluorescence of uranyl salts has been measured at 293°, 77°, and 4°K with a photoelectric gate circuit technique. The resultant mean lives of the excited states in general increase sharply with decreasing temperatures. This indicates that at the higher temperatures where relaxation times as low as 50 microseconds are found the upper states are destroyed chiefly by interaction with the crystal lattice. The lifetime of the undisturbed UO_2^{++} ion must be more than 2 milliseconds. This is in agreement with the brightness of the fluorescence which normally increases in proportion with the mean life. (auth)

3445
TRANSITION IN 26-min U^{235m} OF LESS THAN 23 ELECTRON VOLTS. M. S. Freedman, F. T. Porter, F. Wagner, Jr., and P. P. Day (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 836-41(1957) Nov. 1.

The conversion electron spectrum from the decay of 26-min U^{235m} has been examined by both magnetic spectrometry employing preacceleration and by electrostatic spectrometry. The energy distribution is peaked at 0.5 electron volts, with evidence of structure at 5 ev and at 19 ev, leading to an estimated upper limit of 23 ev for the transition energy. Tests of the performance of the apparatus were made with the conversion spectrum of the low-energy transition in 6-hr Tc^{99m}, redetermined as 2.15 kev; with the "zero energy" peak of Am^{241} and with the spectrum of photoelectrons excited from silver with ultraviolet light. (auth)

PATENTS

Chemistry

3446
ION EXCHANGE SUBSTANCES. J. Kennedy (to U. K. Atomic Energy Authority). British Patent 777,248. Nuclear Eng. 2, 494(1957) Nov.

A cationic exchange resin of high adsorption of the uranyl ion compared with that of many common cations is described. It is an alphyl-allyl hydrogen phosphate polymer, the alphyl group being either allyl or a lower alkyl group (such as methyl or ethyl). (auth)

3447
SEPARATION OF PLUTONIUM AND URANIUM FROM FISSION PRODUCTS. J. K. Dawson and A. E. Truswell (to U. K. Atomic Energy Authority). British Patent 778,051. Nuclear Eng. 2, 494(1957) Nov.

Production of plutonium and recovery of uranium from neutron irradiated uranium by organic solvent extraction of the nitric acid solution of the irradiated uranium in a number of stages does not readily eliminate all fission products from the uranium and plutonium. Some products, particularly ruthenium, present difficult problems. A simple method of separating plutonium and/or uranium, especially from ruthenium and rhodium, consists in treating the metal or compound with a gaseous fluorinating agent (hydrogen fluoride; chlorine trifluoride; bromide trifluoride) in admixture with 2 to 10% of a gaseous oxidizing agent (air; oxygen). (auth)

3448
RECOVERY OF URANIUM FROM NATURALLY OCCURRING MATERIALS. F. H. Burstall, T. V. Arden, G. L. Milward, and G. A. Wood (to U. K. Atomic Energy Authority). British Patent 778,061. Nuclear Eng. 2, 538(1957) Dec.

This is an anion exchange process for treatment of aqueous solutions containing small amounts of uranyl sulfate and large amounts of ferric sulfate. The aqueous sulfate solutions containing uranium and ferric iron are brought into contact with an anion exchange resin having at

exchange positions certain tertiary amine groups, e.g., prepared from cross-linked polymeric substances, to bring about adsorption of the uranium on the resin, which is subsequently eluted from the resin (by means of aqueous ammonium nitrate solution acidified with nitric acid). (auth)

3449

PREPARATION OF ALLYL PHOSPHITES. J. Kennedy (to U. K. Atomic Energy Authority). British Patent 778,077. Nuclear Eng. 2, 494(1957) Nov.

A mixture of equimolecular proportions of allyl alcohol and a tertiary amine base is slowly mixed with a reacting proportion of phosphorous trichloride at a temperature in the neighborhood of 0 deg. C or lower. The mixture is then allowed to attain ordinary temperature. (auth)

3450

PROCESS FOR REMOVING HAFNIUM FROM ZIRCONIUM. I. E. Newnham (to Commonwealth Scientific and Industrial Research Organization). British Patent 778,192. Nuclear Eng. 2, 494(1957) Nov.

The tetrahalides of zirconium are reducible at temperatures at which the corresponding tetrahalide of hafnium undergoes no reduction. This is the basis of the method in which the tetrahalides are heated with finely divided zirconium metal (magnesium, aluminum, zinc, or other metal of sufficient oxidation reduction potential) to a temperature at which hafnium tetrahalide still remains unreduced, which can then be removed from the reaction mass. (auth)

3451

URANIUM RECOVERY PROCESS. (to W. R. Grace and Co. (U.S.A.)). British Patent 779,008. Nuclear Eng. 2, 538 (1957) Dec.

A method for the recovery of uranium from the leached residue or mud of the "Clinker" process for the manufacture of phosphoric acid is described. Because of the shortage of sources, commercial grade phosphate rock, which contains 0.01 to 0.02% uranium is coming under consideration as a possible uranium source. As large amounts of this rock are worked annually the total yield would be considerable if this source could be exploited. In the "Clinker" process, the ground rock is acidulated with anhydrous (over 95%) sulfuric acid, then the material is calcined and a relatively dry solid produced from which the phosphoric acid is leached with water. The leached mud is now dried and ground, the ground material roasted at a temperature between 1,245 and 1,475°F and the uranium is then dissolved with a dilute solution of a strong mineral acid (sulfuric, nitric, hydrochloric; phosphoric acid). The mud is filtered and washed with cold water. About 70 to 80% will easily be recovered in the acid and washings. (auth)

3452

ADSORPTION OF METAL SALTS ON NEUTRAL POLYMERIC ADSORBENTS. J. Kennedy (to U. K. Atomic Energy Authority). British Patent 779,739. Nuclear Eng. 2 538(1957) Dec.

A solution of a uranyl, ferric, lithium, cobaltous salt, or other metal salt soluble in ketonic or alcoholic solvents, in which the salts are not appreciably ionized, is brought in contact with a polymer derived from triallyl-phosphate. (auth)

Engineering

3453

VALVES FOR CONTROLLING HIGH-TEMPERATURE FLUIDS. F. L. Speed (to U. K. Atomic Energy Authority). British Patent 777,039. Nuclear Eng. 2, 494(1957) Nov.

A valve for high-temperature liquid (sodium) with a self-sealing leak-proof gland of (a plurality of) O-ring seals arranged as an insert over the spindle on a sleeve-like extension of the valve body. The extension and the spindle are of such length that combined with fins around the extension, a temperature drop is caused between the valve seat and the gland which results in liquid sodium passing through the valve becoming solid at the gland. (auth)

3454

MANUFACTURE OF BAROMETRIC BELLOWS AND LIKE CORRUGATED TUBES. H. W. G. Wolley (to U. K. Atomic Energy Authority). British Patent 777,146. Nuclear Eng. 2, 494(1957) Nov.

Uniform wall thickness of the order of 0.02 inch within a tolerance of ±0.001 inch is obtained by forming the corrugations successively in a shaping die while the unformed part of the tube follows unrestrained axially the movement caused by the forming operation. (auth)

3455

VARIABLE-SPEED GEARING. K. H. Dent (to U. K. Atomic Energy Authority). British Patent 777,420. Nuclear Eng. 2, 494(1957) Nov.

In the movement of control rods in one type of nuclear reactor it is required that the rods are withdrawn at one tenth of the speed at which they are inserted. This can be achieved by a gearing in which the input shaft is driven by an electric motor having a sun gear fixed to the shaft and an output gear wheel meshing with a wheel fixed to rotate with a planet wheel. The planet wheel is rotatable on a carrier in mesh with the sun wheel. A mechanical freewheel device is provided between input shaft and carrier and an electromagnetic brake for restraining the carrier. A single switch with multiple contacts reverses the drive and changes the energization of the electromagnetic brake so that the reversal of the rotation of the motor coincides with the change of the speed ratio. (auth)

3456

VARIABLE-SPEED GEARING. K. H. Dent (to U. K. Atomic Energy Authority). British Patent 777,421. Nuclear Eng. 2, 494(1957) Nov.

An arrangement for slipping of the coupling in the gear described in B.P. 777,420 in order to make jamming of the control rods harmless by letting them fall under gravity on failure of the gear is described. (auth)

3457

PRESSURE VESSELS. A. F. G. Austin (to Whessoe, Ltd.). British Patent 777,599. Nuclear Eng. 2, 494(1957) Nov.

The connection of branch pipes to pressure vessels raises special stress problems. The problems of avoiding an abrupt change of contour and of enabling examination of the weld can be solved by the arrangement in the aperture for the branch of a ring of special shape whose outer edge is equal in thickness to that of the wall of the vessel and which is butt welded to the surrounding wall. The thickness of the ring increases smoothly from its outer edge to a value around its inner edge at a calculated ratio (stress concentration through piercing the vessel). The ring provides at or near its inner periphery a flange to be butt welded to the branch pipe. (auth)

3458

POWER PLANT INCLUDING A NUCLEAR REACTOR. W. Eccles (to Metropolitan-Vickers Electrical Co., Ltd.). British Patent 778,941. Nuclear Eng. 2, 538(1957) Dec.

It is difficult to supply a varying load from a reactor plant, since, among other reasons, the power required to circulate the heat carrier (liquid metal) may be high in comparison with the total power generated. This approach to the problem has been by varying the temperature of the motive fluid (steam) in the boiler plant, to control the heat

transfer from the heat carrier fluid, which flows around a closed circuit without appreciable variation in its temperature. The example shows a multi-pressure stage steam boiler plant for respective stages of a steam turbine. Steam is diverted from the high pressure feed lines if the turbine load demand falls. The supply to the steam turbine plant is interrupted if the load demand rises and tends to cause reduced boiler pressure. Excess steam is diverted to the condenser plant. (auth)

3459

SEALING MEANS FOR RECPTACLES CONTAINING METAL IN LIQUID OR FUSED STATE. (to Allmanna Svenska Elektriska A. B. (Sweden)). British Patent 780,151. Nuclear Eng. 2, 538(1957) Dec.

The conventional solid sealing means, rings of soft wire laid between flanges of the receptacle, are separated from the liquid metal by a cushion of inert gas introduced into a chamber between the sealing means and the interior of the receptacle. This provides a safe seal (e.g. for pipelines and receptacles containing liquefied sodium as coolant) where covers have to be removable, and are sometimes moved by remote control. (auth)

Mineralogy, Metallurgy, and Ceramics

3460

COLD DRAWING OF TITANIUM OR TITANIUM BASE ALLOYS. S. Hands and J. Humpage (to I.C.I., Ltd.). British Patent 776,371. Nuclear Eng. 2, 494(1957) Nov.

The high coefficient of friction between titanium and the die materials makes drawing difficult. This difficulty is overcome by providing the rod, wire, tube, or the like to be drawn with an anodically produced coating from an electrolyte of orthophosphoric acid (80%), sulfuric acid (10%) and water (10%). (auth)

3461

ALLOYS OF MAGNESIUM. R. A. U. Huddle, J. Laing, A. C. Jessup, and E. F. Emley (to U. K. Atomic Energy Authority). British Patent 776,649. Nuclear Eng. 2, 494(1957) Nov.

An alloy of high magnesium content, 0.008 to 0.1% beryllium and 0.25% aluminum, is reported. Calcium may also be present (0.02 to 0.44%). The alloys could be melted in their oxide skin in air without taking fire, e.g., for aircraft landing mats. (auth)

3462

MANUFACTURE OF TITANIUM. J. J. Gray (to I.C.I., Ltd.). British Patent 776,739. Nuclear Eng. 2, 494(1947) Nov.

A commercially useful rate of producing titanium metal by reduction of titanium tetrachloride with sodium without a dangerous rise in the temperature of the reaction mass is maintained by arranging conditions so that part of the heat of reaction is dissipated by vaporizing a proportion of the molten sodium. The vapor is subsequently condensed and the liquid metal returned to the reaction zone. (auth)

3463

COATING METALS. R. L. Samuel (to Diffusion Alloys, Ltd.). British Patent 776,865. Nuclear Eng. 2, 494(1957) Nov.

A molten metal is cast in a sand mold which has been provided with a coating of a powder containing or consisting of the metal with which the cast metal is to be coated. A fluxing medium assists the fusion of the metals. Coating metals may be Cr, Zr, Ni, Co, Cu, and their alloys. (auth)

3464

ELECTROLYTIC METHOD AND MEANS FOR PRODUCTION OF REFRACTORY METAL. (to Titan Co., Inc. (U.S.A.)). British Patent 777,829. Nuclear Eng. 2, 538 (1957) Dec.

The production of titanium, zirconium, hafnium, thorium, vanadium, niobium, tantalum, chromium, molybdenum, and tungsten of high purity directly from metal halides is described. It has been discovered that the production, particularly of titanium and zirconium metals, may be considerably improved not only by confining the reduced metal halide to the immediate vicinity of the cathode but by retaining the refractory metal deposit in toto on the cathode. Substantially all of the refractory metal is recovered as a highly ductile commercially acceptable product. The metal halide is introduced into the electrolyte through a feed pipe having a (cathodic) basket attached thereto submerged in the electrolyte. (Add. to: 734,094). (auth)

Physics

3465

DISPENSING APPARATUS FOR LIQUIDS. J. Waddell, H. F. Parker, and H. Haselden (to U. K. Atomic Energy Authority). British Patent 776,617. Nuclear Eng. 2, 494 (1957) Nov.

The problem of sampling radioactive liquors is one of minimizing radiation and avoiding spilling (contamination). A small-capacity reservoir, which can be flushed with liquid and then filled to a predetermined level carries a hypodermic-type needle with its unpointed end open to the reservoir below that level and its pointed end exposed above it. A rubber-capped evacuated bottle of greater capacity than the volume of liquid in the reservoir can be advanced and withdrawn on to and away from the needle which thereby penetrates the cap and injects liquid into the bottle. The sampling machine has a row of sampling points and a mechanism for bringing a bottle over these points by means of a long pair of curved tongs and mirror viewing through periscope behind a shielding wall. (auth)

3466

PARTICLE ACCELERATORS. (To General Electric Co. (U.S.A.)). British Patent 776,802. Nuclear Eng. 2, 494 (1957) Nov.

The x-ray output from a particle accelerator is synchronized with the motion of a recurrently moving object in order to make a radiograph of this object. It is thus possible to obtain internal stroboscopic radiographs of machines with recurrently moving internal objects by injecting particles into the accelerator only when the cycle commences within a fixed time interval after that body reaches a triggering position whereupon an x-ray target is bombarded with these particles. (auth)

3467

ELECTROMAGNETIC SURVEY APPARATUS. (To Canadian Airborne Geophysics, Ltd.). British Patent 777,402. Nuclear Eng. 2, 494(1957) Nov.

An arrangement of receiving and transmitting coils and circuitry is described, placed together in a single "bird" towed under a prospecting aircraft at a distance therefrom eliminating interference from the aircraft components. As the transmitting coil is remote from the aircraft it can operate much more closely to the ground surface without danger to the aircraft. (auth)

3468

ION SOURCES. (to Philips Electrical Industries, Ltd. (France)). British Patent 778,434. Nuclear Eng. 2, 538 (1957) Dec.

Alkaline ions or earth alkaline ions are produced on an anode heated so as to vaporize the metal (to 700 to 1,000°C). The anode is arranged inside the supply space in front of

an aperture so that neutral vapor atoms cannot penetrate through the aperture without colliding at least once against the heated anode face whereby they are ionized. For production of cesium, rubidium, potassium, barium, sodium, or lithium ions a platinum anode may be used. Also an anode of nickel, iron, carbon, molybdenum, or tungsten may be employed as a delay element in an electric circuit and as an ion source for nuclear physics. (auth)

3469

FUEL ELEMENTS FOR NUCLEAR REACTORS. J. W. Kendall and C. R. Tottle (to U. K. Atomic Energy Authority). British Patent 778,881. Nuclear Eng. 2, 538(1957) Dec.

Elements having a highly enriched fuel content may become dangerous because on melting they may cause the build up of a super-critical mass leading to a nuclear explosion. This may, e.g., occur by complete loss of coolant from the reactor core. This danger can be eliminated by an element composed of an outer and an inner tubular sheath of different materials between which the fuel is contained in tubular form. The material of the inner sheath is so selected that it collapses at a lower temperature than the outer sheath. When such a collapse occurs some of the fuel content discharges under gravity along the inside of the outer sheath. Three examples are given: (1) fuel content and inner sheath after mutual solid diffusion form a molten alloy while no reaction occurs with the outer sheath; (2) an inner sheath of two-ply material forming a binary eutectic at a temperature higher than 50°C below the melting point of the fuel content and more than 200°C below that of the outer sheath; (3) a single material for the inner sheath (vanadium) that melts at a temperature higher than 50°C below the melting point of the fuel content (enriched uranium) and more than 200°C below the melting point of the outer sheath (of niobium). (auth)

3470

NUCLEAR REACTOR. F. W. Fenning and R. F. Jackson (to U. K. Atomic Energy Authority). British Patent 779,134. Nuclear Eng. 2, 538(1957) Dec.

A method is described for the production of radioactive isotopes and heat with safety in graphite moderated air-cooled reactors. To ensure a maximum of safety, control of the level of radiation is necessary over the entire plant and including the environs of the establishment. Means are provided to detect the individual channel where a fault has occurred. The reactor is described in detail and with reference to 27 figures and a whole reactor is the only claim. For all control and monitoring operations and for the primary alarm and safety systems neutron measurements are made using ion chambers. The presence of active dust (uranium oxide particles) at the outlets of the (33) vertical rows of uranium channels is detected by cotton cords in the cooling air issuing from the channels. They remain in front of the channels for 20 minutes and then are hauled rapidly to Geiger counters. Their amplified output is fed to a bank of four automatic recorders. Variations in the record can be identified with a particular channel. (auth)

3471

NUCLEAR REACTOR. R. V. Moore and G. Packman (to U. K. Atomic Energy Authority). British Patent 779,408. Nuclear Eng. 2, 538(1957) Dec.

A fuel element comprising a fissile fuel member sheathed in a protective can and suitable for stacking vertically to form a column is described. The heat transfer from the element is controlled, e.g., by the use of poor heat conductors between the fuel members and the parts of the protective can reaching into a coolant stream, so that those parts of the can which are stressed by the weight of the other members are kept at a lower temperature than the unstressed parts. (auth)

3472

RADIATION MEASUREMENTS BY MEANS OF A GLOW DISCHARGE COUNTER. (to Siemens and Halske A. G. (Germany)). British Patent 779,455. Nuclear Eng. 2, 538 (1957) Dec.

A measuring instrument is described which is sensitive to all electromagnetic rays of wavelength equal to or smaller than that of visible light and to ionizing corpuscular rays. The impulses produced are approximately 50 volts in amplitude and 1/1,000 sec long, and can be counted or integrated without electronic aid. The instrument might be used, e.g., as an x-ray dosimeter, for measuring radioactive dust, or for registering radioactive tracers. The influence of ionizing rays on the ignition of glow discharge areas serves to measure their intensity. Electrode material free from after-effect (silver steel, etc.) is used and pure inert gases (neon, argon) as filling. (auth)